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## FURTHER OBSERVATIONS ON THE INCIDENCE OF HÆMOLYTIC STREPTOCOCCI IN THE TONSILS.

By IAN MACDONALD, R. T. SIMMONS and E. V. KEOGH.

(From the Commonwealth Serum Laboratories, Melbourne.)

IN a recent paper[1] we reported that hæmolytic streptococci of group A (Lancefield) were isolated from 50% of a group of tonsils excised at the Children's Hospital, Melbourne. Hæmolytic streptococci of the other groups (B, C and G), which are seldom responsible for serious disease in man, were isolated from 22% of the same group of tonsils. The preponderance of the potentially pathogenic group A strains in these excised tonsils was contrasted with the results of examination of throat swabs from healthy children and adults, in which the strains other than A were in excess. We concluded that many children recommended for tonsillectomy are chronic carriers of pathogenic streptococci in the tonsils.

S. D. Elliott[2] has reported similar findings in England. Hæmolytic streptococci were isolated from 87 cultures (64%) made from tonsils from 137 patients, and were present in profuse culture in 54 (39%). In 44 unselected cases, in which the tonsillar cultures yielded hæmolytic streptococci, a serological identification of the organisms was made and 39 of the 44 strains (89%) belonged to group A. Elliott considered that a carrier rate of 60% of *Streptococcus pyogenes* (that is, group A hæmolytic streptococci) was not altogether surprising, since most of the patients had diseased tonsils, although it was not customary to admit patients to hospital for tonsillectomy within six weeks of an attack of tonsillitis.

In this paper we report the results of the bacteriological examination of 251 tonsils removed at the Adelaide Hospital, and of another series of swabs from healthy children. The normal throats previously examined included those of a number of

adults. Through the cooperation of Dr. Eileen Fitzgerald, Chief Medical Officer of the Victorian Department of Education, we have been able to examine throat swabs from a number of school children of the same age and social class as those attending the Children's Hospital, Melbourne, for tonsillectomy. One of us personally obtained these swabs, and paid particular attention to the condition of the tonsils in each child.

The technical methods employed have been previously described.[1]

### Results of Examination of Tonsils Removed at the Adelaide Hospital.

Tonsils from 251 patients were examined. The larger of each pair was chosen for bacteriological examination. Hæmolytic streptococci were isolated from 188 tonsils (74·9%). From ten tonsils strains of more than one serological group or of more than one type within group A were isolated as follows:

Two tonsils: One group A and one group B strain.

Three tonsils: One group A and one group C strain.

Four tonsils: Two group A strains of different serological type.

One tonsil: Two different group A strains and one group C strain.

Group A strains were isolated from 158 tonsils (62·9%) and strains of groups B, C and G from 41 tonsils (16·1%). There were 15 group B, 16 group C and 10 group G strains.

In these tonsils excised at Adelaide, therefore, there was the same striking preponderance of group A streptococci as in the tonsils excised in Victoria. The group A strains were typed by the Griffith technique; but the findings are irrelevant to the purpose of this paper.

### Results of Examination of Throat Swabs from School Children.

Throat swabs were examined from 210 children in six schools in different districts in Melbourne. A single class in each school was selected. The swabs were plated within two hours. Hæmolytic streptococci were isolated from the swabs of 56 children (26·7%). Group A strains were recovered from 28 children (13·3%), and strains other than A from 29 children. From one child, both a group A and a group C strain were isolated. The number of swabs yielding a growth on culture was remarkably uniform in classes composed of children in various age groups, and in different schools, as is shown in Table I.

The frequency of group A streptococci (13·3%) was higher than that (4·5%) found in our previous examination of presumed healthy throats, in which series a large number of adults was included; but it is only a fraction of their frequency in excised tonsils. The percentage of swabs yielding strains other than A is practically the same in both series. Of the 28 group A strains, almost half (12) belonged to type 6 (Griffith); this has been the common non-scarlatinal epidemic strain in Melbourne for the past two years.

The swabs from 48 of 141 children with tonsils yielded a growth of hæmolytic streptococci (34·0%),

TABLE I.

*Incidence of Hæmolytic Streptococci in Throat Swabs from School Children.*

| Class. | Age Group. (Years.) | Number of Children. | Number of Swabs containing Hæmolytic Streptococci. | | Total Swabs containing Hæmolytic Streptococci. |
|---|---|---|---|---|---|
| | | | Group A. | Groups B, C and G. | |
| A | 4 to 7 | 30 | 4 | 7 | 11 |
| B | 9 to 10 | 33 | 4 | 4 | 8 |
| C | 9 to 12 | 45 | 4 | 8 | 12 |
| D | 10 to 12 | 33 | 5 | 4 | 9 |
| E | 11 to 14 | 35 | 5 | 2 | 7 |
| F | 12 to 14 | 34 | 6 | 4 | 9 |
| Total.. | | 210 | 28 | 29 | 56 |

whereas those of only 8 of 69 children without tonsils yielded a growth (11·6%). The difference is statistically significant ($P$ = 0·0018). Hæmolytic streptococci were isolated less frequently from the swabs of children whose tonsils were of normal size or only slightly enlarged, than from those of children with much enlarged tonsils. There were 19 children with much enlarged tonsils and 10 of the swabs yielded hæmolytic streptococci. The number in this group is small and the increased incidence, as compared with that among children with normal or only slightly enlarged tonsils, is not statistically significant ($P$ = 0·066). The incidence of hæmolytic streptococci in the group of children with much enlarged tonsils approximates that in tonsils excised in Melbourne. Since gross enlargement of the tonsils in children is perhaps the commonest indication for their removal, this correspondence is to be expected.

TABLE II.

*Relation between the Size of Tonsils and the Presence of Hæmolytic Streptococci in Throat Swabs.*

| Number of Children. | Size of Tonsils. | Swabs containing Hæmolytic Streptococci. | | All Groups Combined. |
|---|---|---|---|---|
| | | Group A. | Groups B, C and G. | |
| 69 | Absent. | 2 | 6 | 8 (11·6%) |
| 78 | Not enlarged. | 13 | 13 | 26 (33·3%) |
| 44 | Slightly enlarged. | 7 | 5 | 12 (27·3%) |
| 19 | Markedly enlarged. | 6 | 5 | 10 (52·6%)[1] |

[1] Both group A and group C streptococci were isolated from one tonsil in this group.

### Discussion.

The serological classification of hæmolytic streptococci introduced by Lancefield enables a distinction to be made between those strains which, as pathogens or potential pathogens of man, are of epidemic importance, and those which are harmless saphrophytes or opportunist pathogens. Evidence has accumulated in the past few years to show that the distribution of the pathogenic group A strains is limited. Their natural habitat is the human throat, and probably the tonsils are their chief reservoir. Group A streptococci are found in the majority of tonsils removed at operation. These tonsils have been removed for clinical indications, and it might be expected, as Elliott (*loco citato*)

suggests, that a high proportion of diseased tonsils would contain pathogenic streptococci. There is no direct evidence to show that apparently healthy tonsils do not contain such streptococci in equal numbers. There are obvious practical difficulties in obtaining tonsils from healthy subjects for bacteriological examination. Indirect evidence has been presented to show that the grossly enlarged tonsil is more likely to carry hæmolytic streptococci. Children whose tonsils have been removed are fully susceptible to throat infection with hæmolytic streptococci, but the infection, once contracted, does not persist nearly so long in them as in the throats of children with tonsils.[3] Children without tonsils are less frequently carriers than are children with tonsils. Children with enlarged tonsils are more frequently carriers than are those with tonsils of normal size.

The source of the streptococci found in puerperal and surgical streptococcal infections is therefore probably the human tonsil. The same serological types of group A streptococci are found in tonsillar swabs and in excised tonsils as in puerperal and surgical infections and in the same relative proportions.[1] It is often suggested that large numbers of tonsillectomies are performed nowadays on inadequate grounds, and without any benefit to the children subjected to operation. Although we do not seek to justify such "ritual" tonsillectomy, as it is described by the Schools Epidemic Committee of the Medical Research Council of the Privy Council, the practice may have indirectly benefited the health of children escaping the operation, for mass tonsillectomy, by reducing the numbers of streptococcal carriers, may conceivably reduce the incidence and free spread of streptococcal disease.

#### Acknowledgements.

We are grateful for the assistance of Dr. Eileen Fitzgerald and Professor E. Weston Hurst in obtaining the material examined in this investigation.

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(2) S. D. Elliott: "Bacteriæmia following Tonsillectomy", *The Lancet*, Volume CCXXXVII, September 9, 1939, page 589.
(3) E. V. Keogh, I. Macdonald, J. Battle, R. T. Simmons and S. Williams: "Some Factors Influencing the Spread of Scarlet Fever in an Institution", *The Journal of Hygiene*, Volume XXXIX, November, 1939, page 664.

## THE SCHULTZ SYNDROME (GRANULOCYTOPENIA), WITH SPECIAL REFERENCE TO ITS TREATMENT WITH EXTRACT OF YELLOW BONE MARROW.[1]

By E. B. DREVERMANN and HILDA J. GARDNER,
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SINCE Schultz[1] first reported five patients suffering from a syndrome in which there was a gross reduction in the polymorphonuclear cells of the blood associated with necrotic areas in the pharynx, numerous cases have been recorded and much work has been directed towards ascertaining its cause and investigating methods of treatment. Various terms have been applied to the condition, among them agranulocytosis, malignant neutropenia and granulocytopenia. We use the term "Schultz syndrome" in order to distinguish the disease from other blood dyscrasias in which neutropenia is present, and from symptomatic neutropenias.

[1] This work was done with the aid of a grant from the National Health and Medical Research Council.

#### Ætiology.

Although the majority of cases may be attributed with a high degree of probability to known causal agents, there is a small proportion which must be regarded as idiopathic. The condition may occur as the result of excessive use of, or sensitivity towards, a number of drugs, including amidopyrin, arsphenamine, dinitrophenol, antipyrin, acetanilide, cinchophen, "Neostibosan", quinine, gold salts and sulphanilamide. The ætiological relationship is clearly defined only in the case of amidopyrin and its derivatives, which include "Allonal", "Amytal Compound", "Amidophen", "Asciatine", "Cibalgin", "Compral", "Gardan", "Hebaral Sodium" with amidopyrin, "Etipiron", "Novalgin", "Sinepan", "Optinoktin", "Prokliman", "Phenalgin", pyramidon, "Somnosal", "Trigemin", "Veramon" and "Veropyron". This relationship has been made clear by Plum,[2] who showed that almost every subject in his own series and in those reported by others had taken amidopyrin or a closely allied drug. Kracke[3] also demonstrated the sensitivity of a patient to amidopyrin, and subsequently[4] stated that before any drug was accepted as an ætiological factor the following criteria had to be fulfilled: (*a*) it had to produce leucopenia in a patient who had recovered, (*b*) other leucocytic depressants had to be eliminated, (*c*) the leucopenia had to be distinguished from that of sepsis or of other blood dyscrasias. The wide variation in the dosage of amidopyrin causing symptoms of granulocytopenia, and the relative rarity of the disease as compared with the number of persons who take amidopyrin, indicate that the affected persons may have been sensitive to the drug. Rawls[5] has provided further evidence in this direction, for he found that only 1% to 2% of persons showed changes in the white cells of the blood after the administration of amidopyrin. A similar sensitivity may exist to sulphanilamide. Although some of the patients reported to be suffering from neutropenia following the administration of sulphanilamide have also taken amidopyrin,[6] a number have not had any other drug. In addition, McGuire and McGuire[7] have reported a case, with recovery, following sulphanilamide therapy; in this there was a reduction in the polymorphonuclear count when sulphanilamide was again administered. Britton and Hawkins,[8] by observing the effect of sulphanilamide on fifty ambulant patients, showed that a comparatively small amount (21 grammes in fourteen days) would produce a transient polymorphonuclear leucopenia in 50% of patients. The usual dose of sulphanilamide given to patients in whom granulocytopenia

has been produced has been in the region of 50 to 60 grammes, but in one of the cases reported here (Case IV) the dose was considerably smaller and the condition developed after sulphanilamide therapy had been discontinued and again resumed. The majority of patients taking sulphanilamide do not develop the Schultz syndrome. It is possible that a subject may be sensitive to one drug without being sensitive to another (Case VI). Recently a number of cases following the use of "M & B 693" sulphapyridine) has been recorded.[9] Case III of this series was probably due to the drug.

#### Sex and Age Incidence.

The condition is much more common in women than in men—five out of six of our patients were women—and may occur at any age, though it is most common between forty and sixty years. The age and sex incidence is probably related to the more frequent use of amidopyrine by women of this age rather than to any increase in the incidence of sensitivity.

#### Signs and Symptoms.

The condition is usually characterized by a pharyngitis which may or may not be ulcerative, pyrexia which appears to be out of all proportion to the lesions, and severe prostration. We have observed ulcers in the pharynx of varying depth, covered by a thick white membrane, the edge of the ulcers showing a bright red hyperæmic reaction. The skin may also show lesions, which may appear in any region, but are apparently more common on the forehead and hands. They first appear as a herpetiform rash, the vesicles of which coalesce and rapidly ulcerate. In the two cases in which we have observed skin lesions, these have shown a hyperæmic reaction at the edge, like that which occurs in the pharynx (Cases II and VI). Similar ulcerative lesions may also occur in the intestinal tract and vagina. Jaundice due to a hepatitis is said to occur in 50% of cases; but we have not observed it in any of our patients. Examination of the blood reveals a rapidly increasing neutropenia, the lymphocytes and monocytes at first remaining within normal limits. These latter, however, may soon show a diminution, so that the total leucocyte count may fall below 1,000 cells per cubic millimetre, and always below 2,500 per cubic millimetre, before symptoms develop. Frequently no neutrophile cells can be discovered. There is, however, no significant anæmia unless the case is of the chronic or recurrent type. The platelets are also unaffected.

#### Diagnosis and Differential Diagnosis.

Every effort should be made to arrive at an early and correct diagnosis. This can be done only by careful clinical observation of the patient, together with a cytological blood examination.

The differential diagnosis is from ulcerative conditions of the pharynx, which include atypical diphtheria, ulcerative pharyngitis and Vincent's angina, and from other blood dyscrasias, including glandular fever, aleuchæmic leuchæmia and aplastic anæmia. The first three conditions can be distinguished by bacteriological investigation and by a comparatively simple blood examination. More detailed blood investigation is, however, required to make the differential diagnosis from the last three conditions. Glandular fever is characterized by the lymphocytosis, the glandular enlargement, and by the demonstration of the presence of heterophile agglutinins for sheep's red cells in the patient's serum (Paul and Bunnell's test). Leuchæmia and aplastic anæmia are distinguished by the striking fall in the red cell count and hæmoglobin percentage. Blood examination may be supplemented by a biopsy of the sternal marrow.

That the clinical differential diagnosis from acute aleuchæmic leuchæmia may be very difficult is shown by Case VIII. Apart from the blood examination, however, the temperature was lower than one would expect in a true Schultz syndrome, the pharyngeal lesions showed no hyperæmic edge and the patient was generally in better condition. Enlargement of the glands, though slight, was also present. Although this may occur in neutropenia (Case IV), it is usually absent. The history in Case VIII did not indicate any causal drug, though this also applies to the idiopathic cases.

The pathology of the pharyngeal ulceration in acute aleuchæmic leuchæmia, according to Wright Smith,[10] appears to be different from that of the Schultz syndrome. In the former there is a primary infiltration by leuchæmic cells with subsequent ulceration, while in the latter ulceration is caused by the invasion of organisms into tissue which is rendered incapable of opposing them by the absence of polymorphonuclear leucocytes. The post-mortem examination in Case VIII revealed areas of infiltration with leuchæmic cells in the larynx.

#### Pathology.

Descriptions of bone marrow at autopsy vary from the recording of complete aplasia of the white cells and their antecedents, through comparatively normal marrow to that in which hyperplasia of the myeloid cells is found. In Cases I and II examination of the bone marrow revealed hyperplasia of the myeloid cells. Plum[2] considers that hyperplastic bone marrow indicates that there has been an attempt at recovery and that aplasia of the myeloid cells is the primary pathology of the condition. Miller[11] showed experimentally in dogs that hyperplasia of undifferentiated myeloid cells with diminution of mature granulocytes followed the administration of amidopyrine. According to Fitzhugh and Krumbhaar[12] and Custer,[13] the usual finding is hyperplasia of myeloblasts, which do not mature further.

It seems probable that arrest of development of the polymorphonuclear leucocytes may take place at different stages. Maturation may cease at a very early stage, before the differentiation of myeloblasts from the primitive cell, or may proceed to a slightly later stage, in which myeloblasts and early myelocytes are found without any advance towards maturity. In the former an aplastic bone

marrow results, while in the latter myeloid hyperplasia is found. This view may be of importance in the treatment of the condition, since a special maturation factor may be required at each level of development.

### Treatment.

The difficulty experienced in causing the disease in animals, as reviewed and demonstrated by Butt, Hoffmann and Soll,[13] prevents their use in assessing the value of individual methods of treatment. It is therefore necessary to use human subjects for this purpose. Some patients apparently recover without any treatment other than cessation of administration of the causal drug, as shown by Plum[2] and by Johnson,[15] and this must be borne in mind when any therapeutic test is being carried out. Neutropenia must be treated as a medical emergency, because death may rapidly follow the onset, and the question arises as to whether the withholding of any form of recommended treatment can be justified.

Methods of treatment include X-ray therapy, introduced by Friedemann,[16] the administration of nucleic acid, pentnucleotide and liver extract. Although some cures were reported with X-ray therapy, it is at present regarded as useless, and Witts[17] states that it may even be harmful. Jackson, Porter and Taylor[18] claimed that by treatment with pentnucleotide the fatalities were reduced to 26%. Although many recoveries have been reported, the mortality rate, as given by Plum,[2] still remains in the region of 70% to 90%. Liver therapy has been used with variable results. However, Das Gupta and Witts[19] report an interesting case in which chronic neutropenia, treated without result with pentnucleotide, was cured after treatment with liver extracts.

More recently, extract of yellow bone marrow, first introduced by Watkins,[20] has been used. Zichis[21] subsequently described a method of preparation of the extract for intramuscular use in laboratory animals. Later, Marberg and Wiles[22][23] described another method of preparing it for oral use, and gave an account of six patients, all of whom recovered after its administration. These had been previously treated with pentnucleotide without result.

We have followed the method of Zichis for the preparation of extract, but have carried the saponification further and have obtained a product similar in appearance to that of Marberg and Wiles. These latter authors state that their extract contains large amounts of cholesterol, but we have not been able to demonstrate its presence. Our extract, like theirs, contains carotene.

### Method of Preparation of Extract.

The yellow bone marrow extract is prepared in the following manner:

Two kilograms of yellow bone marrow, obtained from bullocks, are saponified for twenty-four hours with six litres of 3% alcoholic potassium hydroxide at room temperature. After filtration one litre of distilled water is added to the filtrate and petroleum ether is added in the proportion of one volume to two volumes of the diluted filtrate. The mixture is shaken from time to time during twenty-four hours. The lower layer is then discarded and the upper layer is resaponified with six litres of 3% alcoholic potash. After filtration two litres of distilled water are added to the filtrate, which separates into two layers, the lower of which is discarded. The remaining material is washed five times, on each occasion with 100 cubic centimetres of 40% alcohol. This washed petroleum ether solution is then passed through a Seitz filter into a sterile flask and from this stage all processes are carried out aseptically. The petroleum ether is distilled off at 31° C. and the residue obtained is a reddish brown solid. This is emulsified in 20 cubic centimetres of olive oil and put up in ampoules in amounts of one cubic centimetre, each equivalent to 100 grammes of marrow.

The extract to which we refer in the case reports below is of this type, except in Cases II and III, in which that used was made by following exactly the method of Zichis. It was administered intramuscularly in all cases.

As stated previously, arrest in development of the polymorphonuclear cells may take place at different stages, for each of which a special substance may be required. Since it is not possible to distinguish clinically the stage at which arrest has occurred, we would suggest that in all cases pentnucleotide and yellow bone marrow extract be given together, as each may play a part in the maturation of the polymorphonuclear leucocytes. In some cases liver extract may prove to be of value.

### Prognosis.

Plum[2] states that the mortality rate is from 70% to 90%. He regards the presence of skin lesions, mental confusion and obesity as bad prognostic signs; the mortality in cases in which any one of these is present is 100%. The outlook for elderly people and for those patients who show no polymorphonuclear leucocytes in the blood, is very poor. The patient in Case VI had every bad prognostic sign, but recovered when treated with pentnucleotide and marrow extract despite the development of bronchopneumonia during the recovery stage.

It was suggested to us that in the event of marrow extract being of value in producing maturation of myeloblasts, it might be of use in the treatment of myeloid leuchæmia. It was therefore used in Case IX. No response resulted. Like other observers, we have found it to be of no value in the treatment of aplastic anæmia (Case X).

In the cases reported we have had two recoveries with marrow extract (Cases IV and VI). The latter patient was, however, also treated with pentnucleotide. In one patient (Case III) the blood picture returned to normal; but, despite this, death occurred. Other patients failed to respond at all when treated with marrow extract,[5] with pentnucleotide,[1] or with both pentnucleotide and marrow extract.[2]

We cannot, therefore, suggest that marrow extract is specific in all cases, but rather that it should be used in conjunction with pentnucleotide. Stress should be laid on the necessity for early treatment;

the failure of the remedy when the disease is advanced does not exclude its possible effectiveness if it is administered without delay.

### Reports of Cases.

CASE I.—The patient was in the care of Dr. G. C. Scantlebury and Dr. T. G. Millar at the Royal Melbourne Hospital. A.T., a female, aged thirty-nine years, was admitted to hospital on April 22, 1938, suffering from pharyngitis; on examination no ulceration was present. She had suffered from asthma for many years and was sensitive to aspirin; because of this she was given "Compral" tablets for pain. Local treatment consisted of irrigations and gargles. Her temperature, which was 102° F. on her admission to hospital, subsided on April 23, 1938, and, her throat being clear on April 26, 1938, she was discharged.

On May 5, 1938, she was readmitted to hospital complaining of a painful swelling of the nose and a sore throat. Her temperature was then 102° F., the pharynx was slightly inflamed and there was a small ulcer on the left tonsil. She was given mouth washes and irrigations and "A.P.C." for the pain. Her asthma was aggravated by the aspirin, and this necessitated treatment with morphine, strychnine and atropine, and adrenaline. Aspirin was replaced by "Compral" on May 11, 1938, two tablets being given three times a day. Her condition improved until May 16, 1938, when she complained of general apathy and vague aches and pains. The condition of her throat had by now improved to a great extent. She was given one gramme of "M & B 125" every four hours. In spite of this, her temperature rose rapidly, and on the morning of May 19, 1938, it was 103° F. Her throat was now showing bright red hyperæmia and the ulcer was a little larger, though still shallow. The urine was quite normal. Scattered rhonchi were present in the chest. At 9.30 p.m. the temperature had risen to 105° F.; the patient was very restless and appeared to be extremely ill. The leucocyte count was then 1,200 per cubic millimetre; no polymorphonuclear cells were seen in the film. The administration of "M & B 125" was immediately discontinued, and she was given 20 cubic centimetres of pentnucleotide intramuscularly. This was repeated at midday on May 20, 1938. Despite this treatment her condition deteriorated, and by 2 p.m. she did not recognize her surroundings. A transfusion of fifteen ounces of blood was given between 3 and 4 p.m., but it did not influence her condition and she died at 9.15 p.m.

At post-mortem examination numerous hæmorrhages were present in the pericardium and beneath the capsule of the spleen.

This case is reported since it illustrates the symptomatology of the fulminating type of granulocytopenia. No marrow extract was available at this time.

CASE II.—The patient was in the care of Dr. S. V. Sewell at the Royal Melbourne Hospital. A.G., a female patient, aged twenty-eight years, was admitted to hospital on October 16, 1938, with a history of having had severe pain in the left side of her face twelve months previously. This was diagnosed as *tic douloureux* and was treated by injection and subsequent division of the fifth nerve. Ten months later the pain began on the right side of the face. For this the patient took "Veramon" in large doses. At this time she was admitted to another hospital for investigation. While she was there as an in-patient a pustular condition of the face associated with a very high temperature developed. This subsided after a period of three days. Ten days prior to her admission to the Royal Melbourne Hospital her gums became sore and small eruptions appeared on her face. On the day before her admission to hospital (nine days later) her temperature was 104° F.; it had risen to 106·4° F. and she was very ill when she was admitted on the following day. The pharynx was inflamed and the gums and tongue showed considerable reddening and shallow ulceration. Pustules were present on the forehead and arms. The white cell count was 900 per cubic millimetre; of these, 12% were monocytes, 87% lymphocytes, and 1% eosinophile polymorphonuclear cells. The patient was given one cubic centimetre of marrow extract intramuscularly. On the following day there was no alteration in the leucocyte count and clinically her condition had deteriorated. She was given a further one cubic centimetre of marrow extract intramuscularly and thirty cubic centimetres of pentnucleotide in one pint of saline solution intravenously by the drip method. Some vomiting followed. The marrow extract was repeated in the evening. The leucocyte count was then 750 per cubic millimetre. There was no improvement following this and the treatment of the previous day was continued. The leucocyte count had then fallen to 700 per cubic millimetre. At 7 p.m. on October 18, 1938, a blood transfusion of eight ounces was given by the slow drip method without response, and the patient died at 4.30 a.m. on October 19, 1938.

At autopsy the epicardium and mucosa of the kidney pelves showed numerous recent hæmorrhages. There was no ulceration of the pharynx, but there was superficial ulceration of the gums. The marrow of the ribs was fluid and red. Examination of the femoral marrow showed some replacement with greyish-red soft tissue. A microscopic examination of the marrow showed myeloid hyperplasia.

This case is reported to stress the importance of early diagnosis so that suitable therapy can be instituted before the general condition has greatly deteriorated.

CASE III.—The patient was in the care of Dr. S. V. Sewell and Dr. K. Fairley. Mrs. G. was admitted to hospital on December 28, 1939, suffering from an infected tooth socket and sore throat. Her temperature was 100° F. and rose rapidly to 103° F. She was given "Proseptasine", two tablets every four hours, until eight grammes had been given. The treatment was then changed to "M & B 693" in the same dosage. On January 6, 1939, her temperature had returned to normal, by which time she had taken 18 grammes. Her temperature remained normal until January 15, 1939. During this time her clinical condition was much better and that of her mouth was improving. On January 15, 1939, however, her temperature rose to 100° F., and on January 17, 1939, treatment with "M & B 693" was resumed. By January 21, 1939, her temperature had returned to normal after a further 18 grammes of "M & B 693" had been given; but the lesions had now become ulcerative, and a leucocyte count revealed a gross leucopenia. Her condition was then diagnosed as the Schultz syndrome. "M & B 693" was not discontinued until a further 11 grammes had been given. The condition was complicated by the presence of generalized œdema, apparently due to cardiac failure, which was treated with digitalis and "Salyrgan".

Table I shows the treatment, clinical course of the illness and the progress of the leucocyte count.

No autopsy was obtained.

This patient had taken a proprietary preparation containing amidopyrin for some months in the latter half of 1938; but when inquiries of this nature were instituted the patient's mental condition was not sufficiently good to enable an accurate history to be obtained. It is not known whether she was taking this preparation up to the time of her admission to hospital on December 28, 1938, though none was taken subsequently.

The absence of pyrexia at the time of the diagnosis is interesting, as is also the failure of the marrow extract to produce clinical improvement, though the leucocyte picture returned to normal.

CASE IV.—M.E., a female patient, aged twenty-nine years, had contracted facial erysipelas twenty-one days before her admission to the Queen's Memorial Hospital for

TABLE I.

| Date. | Leucocytes. | Polymorphonuclear Cells. | Treatment. | Reactions and Progress. |
|---|---|---|---|---|
| 21/1/39 | 1,200 | Few. | 1 c.cm. marrow extract. | Local reaction at site of injection, with reddening and swelling. Temperature 102·8° F. |
| 22/1/39 | 1,500 | 50% | 1 c.cm. marrow extract. | Similar reaction, but with rigor. Cyanosis present. Œdema increasing. |
| 23/1/39 | 2,900 | 74% | 1 c.cm. marrow extract. | Similar reaction. |
| 24/1/39 | 8,200 | 78% | | |
| 25/1/39 | 7,200 | 70% | | |
| 26/1/39 | 5,500 | 66% | 1 c.cm. marrow extract. | No reaction. Some purpura present. Mouth more comfortable and lesions healing. |
| 27/1/39 | 4,400 | | 20 c.cms. pentnucleotide. | Severe reaction. Temperature 104·2° F. Pulse 100. Respirations 56. Attempt at culture from blood without result. Swab, many organisms. Many nucleated red cells seen in film. |
| 29/1/39 | 11,700 | | 20 c.cms. pentnucleotide. | Temperature 104° F. Respirations 56. |
| 30/1/39 | 6,250 | | 20 c.cms. pentnucleotide. | Temperature 102° F. Pulse 128. Respirations 36. |
| 31/1/39 | | Death. | | |

Infectious Diseases, Fairfield, on June 13, 1939. Fifteen days previously a course of sulphanilamide therapy, consisting of one gramme three times a day for seven days, was begun. She thus had received 21 grammes of sulphanilamide in this period. Three days before her admission to hospital she had complained of sore throat and was given sulphanilamide the next day. This was changed to "Proseptasine" after twenty-four hours. This made a total of twenty-seven grammes in the fifteen days preceding her admission to hospital.

On her admission to hospital her temperature was 102·8° F. Typical erysipelas was present, with large watery blebs on the forehead and right cheek. Ulceration was noted on both tonsils, and the glands at the right mandibular angle were considerably enlarged. The right eye was inflamed and there was some watery discharge from it. On June 14, 1939, the leucocytes numbered 400 per cubic millimetre; 16% were polymorphonuclear cells. The administration of "Proseptasine", one gramme every six hours, was begun on her admission to hospital. This was discontinued after four grammes had been given. The temperature had now risen to 104° F. On the evening of June 15, 1939, her condition was much the same and two cubic centimetres of marrow extract were given intramuscularly. Her mental condition was good and remained so throughout her illness. The right conjunctiva became ulcerated and the throat lesions extended, while the glands of both sides of the neck were now enlarged. Twenty-four hours after the marrow extract was given young granular cells appeared in the blood film. Thirty-six hours after the injection was made the leucocyte count had risen to 11,000 per cubic millimetre and the polymorphonuclear cells numbered 7,000 per cubic millimetre. This rate of development was maintained and the leucocyte count reached a peak of 63,000 per cubic millimetre on the seventh day after treatment with marrow extract was instituted. The number of mature polymorphonuclear cells was then 33,000 per cubic millimetre, while immature myeloid cells numbered 8,000 per cubic millimetre.

On June 26, 1939, the throat had become clear; the glands on the left side had become fluctuant and thick pus was discharged from them on the following day. The glands on the right side were fluctuant on June 30, 1939; but by this time the right eyeball had ruptured spontaneously and the patient was transferred to the Eye and Ear Hospital. Her temperature had gradually fallen, and at the time of her transfer it was 98·6° F.

The development of the Schultz syndrome after a relatively small amount of sulphanilamide is noteworthy. The recovery of the patient may indicate that the deficient factor was supplied by the marrow extract, although it must always be borne in mind that cessation of administration of the causal drug may result in recovery.

CASE V.—R.L., a male patient, aged thirty-nine years, was admitted to the Queen's Memorial Hospital for Infectious Diseases at Fairfield on July 3, 1939, with a history of asthma during the previous twelve months. For the past eight months he had been taking a mixture containing amidopyrin for pain in his chest. He had developed a sore throat twenty-four hours previously, and on his admission to hospital there was a white membrane with surrounding reddening. His temperature was then 101° F. There was no enlargement of the cervical glands. In the smear from the throat numerous organisms with some *Fusiformis fusiformis* were seen.

On the following day his temperature had risen to 105° F., and the leucocytes numbered 400 per cubic millimetre; no polymorphonuclear cells could be seen in the film. The ulceration in the throat was now dendritic in appearance. He was given two cubic centimetres of marrow extract, but by the evening his condition had deteriorated and he was irrational.

On July 5, 1939, the ulcer showed no change and a further two cubic centimetres of marrow extract were given intramuscularly. This was supplemented by two "glanules" (Amour's yellow bone marrow preparation) given orally three times per day.

On July 6, 1939, the temperature was at the same high level and the ulceration had extended to the palate and gums. There was no leucocytic response to the marrow extract. The patient was semicomatose during the following days and died on July 10, 1939.

This case was of the fulminating type. It suggests the possibility of the absence of some factor other than that present in yellow bone marrow extract. No examination of the bone marrow was made before or after death to determine the stage at which arrest had occurred.

CASE VI.—The patient was in the care of Dr. Euan Littlejohn and Dr. Lucy Bryce. F.A., a female patient, aged seventy-five years, was admitted to hospital on July 15, 1939, suffering from severe sore throat. She had been suffering from asthma for many years. For this she had been given a prescription containing amidopyrin, and without the knowledge of her medical attendant had continued to take it until her admission to hospital. Twelve months previously she had suffered from an ulcerated throat associated with a high temperature and delirium. On her admission to hospital she had an ulcer on the left tonsil. Three days later a small ulcer formed on her right hand. During the following days she was at times mentally confused. A course of sulphanilamide, one gramme every four hours, was commenced.

On July 18, 1939, her temperature was 103° F. and her pulse rate 120 per minute. A large dendritic ulcer, at the edge of which an area of bright red hyperæmia was visible, extended over the left tonsil and the palate. A similar but smaller ulcer was present on the inside of

the right cheek. Skin lesions were present in the form of vesicles on the forehead at the hair line, an ulcer about half an inch in diameter between the first and second metacarpals on the right hand, and a small ulcer on the back of the neck. These lesions had areas of bright hyperæmia at the edges. The leucocytes then numbered 1,200 per cubic millimetre. Of these, 26% were monocytes, the remainder being lymphocytes; no polymorphonuclear cells were found in the film. The patient was then given two cubic centimetres of marrow extract by intramuscular injection, and, after a test dose, 20 cubic centimetres of pentnucleotide by the same route. The sulphanilamide was discontinued. Local treatment to the pharyngeal ulcers consisted of hydrogen peroxide toilets. Table II shows the treatment and the leucocytic and polymorphonuclear responses. The hæmoglobin value was always in the region of 10·5 grammes per 100 cubic centimetres.

The patient's mental condition improved within twenty-four hours after the commencement of treatment, and her temperature returned to normal on the morning of July 20, 1939. In the evening, however, her temperature was again elevated to 102° F., and there were crepitations at the bases of both lungs. On July 21, 1939, all the ulcers showed signs of healing, but there was some induration of the tissues of the right forearm. On July 23, 1939, the signs in the chest had diminished, the glands of the neck had become swollen and tender, and there was slight œdema of the ankles. A further one cubic centimetre of marrow extract was given on July 24, 1939. On the following day an abscess had formed in the right forearm.

The temperature fell gradually and remained in the vicinity of 100° F. until July 30, 1939, when it rose to 102° F. and signs of bronchopneumonia appeared at the base of the left lung. The patient was then given "M & B 693" (soluble) by injection, and a further one cubic centimetre of marrow extract. As shown in Table II, this treatment produced no adverse effects on the leucocyte count. The temperature remained in the vicinity of 100° F. until August 11, 1939, when it fell to normal. The abscess on the forearm was subsequently incised and a quantity of pus was liberated. The ulcers at all sites healed rapidly, the only scar formation being on the right hand. The patient remained under observation in hospital until September 7, 1939, when her leucocyte count had been stable in the region of 7,000 per cubic millimetre for some weeks.

**The notable features of this case were the typical appearance in the throat, the skin lesions, and the dramatic recovery of an elderly person, in the presence of every bad prognostic sign and the complication of bronchopneumonia. It seems possible, however, that the illness twelve months previously was the Schultz syndrome. Spontaneous recovery then occurred.**

CASE VII.—The patient was in the care of Dr. L. E. Hurley. E.B., a female patient, aged fourteen years, was transferred to the Royal Melbourne Hospital on October 4, 1938. An appendicectomy had been performed ten days previously. At operation the liver was found to be enlarged and firm. Six days after operation she complained of sore throat. Examination of a smear from the throat showed *Fusiformis fusiformis* and *Treponema vincenti*, as well as many other organisms. At this time a blood examination gave the following information: erythrocytes numbered 2,440,000 per cubic millimetre, the leucocytes numbered 2,300 per cubic millimetre, and the hæmoglobin value was seven grammes per 100 cubic centimetres.

On admission to the Royal Melbourne Hospital the patient was pale, in a semicomatose condition, and had a temperature of 101° F. and a pulse rate of 128 per minute. The right tonsil was gangrenous and the left was sloughing, while the remainder of the pharynx was hyperæmic. The liver and spleen were both palpable. The leucocytes now numbered 900 per cubic millimetre; very few polymorphonuclear cells were seen in the film. She was given one cubic centimetre of marrow extract intramuscularly.

On October 5, 1938, her temperature was 103° F. A blood examination gave the following information. The hæmoglobin value was 7·1 grammes per 100 cubic centimetres, the erythrocytes numbered 2,360,000 per cubic millimetre, and the leucocytes numbered 1,400 per cubic millimetre. Sixty white cells were counted; of these, five were immature lymphocytes, one was a large lymphocyte, 40 were small lymphocytes, 11 were old metamyelocytes, three were neutrophile polymorphonuclear cells. Aleuchæmic lymphatic leuchæmia was regarded as the most probable diagnosis. She was given a further one cubic centimetre of marrow extract without response. She died on October 6, 1938.

Autopsy revealed lymphocytic and lymphoblastic infiltration of the marrow, spleen, liver and glands. This confirmed the diagnosis of acute lymphatic leuchæmia.

**The factors distinguishing this case from the Schultz syndrome were the presence of an enlarged liver, which was discovered at operation, anæmia, the appearance of the throat and the occurrence of immature cells in the blood film.**

CASE VIII.—The patient was in the care of Dr. S. O. Cowen at the Royal Melbourne Hospital. R.P., a female patient, aged twenty-two years, was admitted to the Queen's Memorial Infectious Diseases Hospital at Fairfield on July 27, 1939, with a history of sore throat for three weeks. She had extensive *herpes labialis*. A large necrotic slough occupied the site of the left tonsil and extended onto the uvula. Slight left cervical adenitis was present. There was no enlargement of the liver or spleen. On July 26, 1939, a smear from the throat was found to contain a few *Fusiformis fusiformis* and

TABLE II.

| Date. | White Blood Cells per Cubic Millimetre. | Neutrophile Cells *per centum.* | Immature Neutrophile Cells. *per centum.* | Monocytes *per centum.* | Lymphocytes *per centum.* | Plasma and Unidentified Cells *per centum.* | Treatment. |
|---|---|---|---|---|---|---|---|
| 18/7/39 | 1,200 | 0 | 0 | 26·0 | 63·0 | 11·0 | 2 c.cms. marrow extract. 20 c.cms. pentnucleotide. |
| 19/7/39 | 1,300 | 0 | 2 | 24·0 | 72·0 | 2·0 | 40 c.cms. pentnucleotide. |
| 20/7/39 | 2,150 | 13·0 | 29·0 | 32·0 | 11·0 | 15·0 | 1 c.cm. marrow extract. 40 c.cms. pentnucleotide. |
| 21/7/39 | 6,150 | 22·4 | 54·8 | 12·0 | 9·6 | 1·2 | 40 c.cms. pentnucleotide. |
| 22/7/39 | 16,200 | 58·0 | 23·5 | 8·5 | 8·0 | 2·0 | 40 c.cms. pentnucleotide. |
| 23/7/39 | 21,000 | 63·0 | 17·0 | 10·7 | 8·3 | 1·0 | |
| 24/7/39 | 19,100 | 66·6 | 17·7 | 6·0 | 9·0 | 0·7 | 1 c.cm. marrow extract. |
| 25/7/39 | 21,300 | 72·4 | 14·7 | 4·0 | 8·7 | 0·2 | |
| 30/7/39 | 13,750 | 82·1 | 7·9 | 3·3 | 6·7 | | Intramuscular administration of "M. & B. 693" begun, 1 gramme daily. |
| 31/7/39 | 12,600 | 75·0 | 10·7 | 6·0 | 8·0 | 0·3 | |
| 1/8/39 | 10,050 | 79·7 | 5·2 | 2·3 | 11·7 | 1·1 | 1 c.cm. marrow extract. |
| 12/9/39 | 7,300 | 45·5 | 1·0 | 6·5 | 47·0 | | |

*Treponema vincenti*. The leucocytes then numbered 12,000 per cubic millimetre; of these, monocytes comprised 98% and polymorphonuclear cells 2%. The following day the number of leucocytes had fallen to 3,000 per cubic millimetre, the differential count being as follows: monocytes 90%, small lymphocytes 10%. Her temperature was 102° F. There was extensive sloughing of the uvula and left tonsil, but without great hyperæmia of the pharynx. The patient was given two cubic centimetres of marrow extract intramuscularly. The number of leucocytes continued to fall, and on August 2, 1939, it was 1,600 per cubic millimetre; no polymorphonuclear cells were present. Ten cubic centimetres of pentnucleotide and a transfusion of one pint of blood were given; but the leucocytes on August 7, 1939, numbered 500 per cubic millimetre. The patient was taken home on August 10, 1939, and was subsequently admitted to the Royal Melbourne Hospital (on August 10, 1939). Following many blood examinations, including supravital staining of the cells, a diagnosis of monocytic leuchæmia was made. Infiltration of the skin later developed. She died on November 2, 1939.

Autopsy revealed monocytic infiltration of the marrow, spleen, liver, lymph glands, lung, skin and larynx.

Although the diagnosis of the disorder presented considerable difficulties in the early stages, the appearance of the throat lesion, its development before the leucopenia in the blood, and the presence of anæmia suggested a condition other than the Schultz syndrome. The administration of marrow extract did not result in the appearance of any polymorphonuclear cells in the blood.

CASE IX.—The patient was in the care of Dr. S. V. Sewell. J.S., a female patient, aged nine years, was admitted to the Royal Melbourne Hospital on July 8, 1939, with a history that following an attack of bronchitis one month previously she had become very pale and languid. Her liver and spleen were then enlarged and the lymph glands in all regions were palpable.

The results of a cytological blood examination on July 10, 1939, were as follows: the hæmoglobin value was 5·4 grammes per 100 cubic centimetres, the erythrocytes numbered 1,600,000 per cubic millimetre, and the leucocytes numbered 34,000 per cubic millimetre. The differential leucocyte count gave the following information: myeloblasts 6%, premyelocytes 16·5%, myelocytes 20%, young metamyelocytes 12%, neutrophile cells 9·5%, eosinophile cells 0·5%, monocytes 0·5%, lymphocytes 13%.

Besides treatment with "Anahæmin" and pentnucleotide the child was given two "glanules" of marrow extract (Armour) three times per day without improvement. On July 27, 1939, one cubic centimetre of marrow extract was given intramuscularly. This had no effect on the blood picture. She died on August 21, 1939. Autopsy confirmed the diagnosis of myeloid leuchæmia.

It is seen that any maturation factor that may have been present in the yellow bone marrow extract did not influence the course of the disease in this patient.

CASE X.—The patient was in the care of Dr. Turnbull. R.C., a male, aged fourteen years, was admitted to the Royal Melbourne Hospital on July 6, 1938. During the past four years he had suffered from a severe hypoplastic anæmia which followed an attack of influenza. This had been treated by repeated transfusions. On his admission to hospital a blood examination showed that the hæmoglobin value was 6·2 grammes per 100 cubic centimetres, the erythrocytes numbered 2,230,000 per cubic millimetre, 1% being reticulocytes, and the leucocytes numbered 1,300 per cubic millimetre.

He was given one cubic centimetre of marrow extract, on two separate occasions, without the production of any significant change in the leucocyte count.

Autopsy performed on December 30, 1938, revealed aplasia of the bone marrow.

This case demonstrates the ineffectiveness of yellow bone marrow extracts in the treatment of aplastic anæmia.


### Summary.

The literature on the Schultz syndrome is reviewed. The preparation of an extract of yellow bone marrow is described. Six cases of Schultz syndrome and four cases of other blood dyscrasias are discussed from the point of view of the diagnosis of the syndrome, and the use of marrow extract in the treatment of various types of leucopenia.



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## THE TREATMENT OF FRACTURES, WITH SPECIAL REFERENCE TO FRACTURE OF SURGICAL NECK OF HUMERUS.

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THE older idea of the treatment of fracture was to splint the fractured limb to immobilize it, and allow the patient to be up and about. The results of this treatment were fairly good; but the reduction of the fracture was apparently not complete, and with the application of splints which did not adapt themselves closely to the limb, union in bad position and non-union often resulted.

The regularity with which bad results presented themselves as a result of this line of treatment led to the development of a new general method. The main principle in this method was the resting of the patient in bed, the fractured limb being splinted; early removal of the splints followed, for daily massage and passive movement, and the splints were replaced afterwards.

This method of massage and passive movement was at a disadvantage in achieving results, for it is now realized that passive movement, far from helping to reduce adhesions and stiffness, greatly tends to aggravate the condition; it is the active coordination in movement of a joint that stimulates blood supply and helps increase the range of movement. Protection of the joint is all-important if pain is induced; hence in the presence of painful passive movement the antagonists of the movement go into active protective contraction, and this spasm frustrates the good intentions of the movement.

The results of this method of treatment were somewhat better, but the bad results were still of frequent occurrence, more as non-union than as mal-union.

After this method followed the treatment, the principles of which are generally accepted today—that of sufficient and efficient immobilization of the site of fracture, with mobilization of the patient. To secure immobilization of the fracture it is necessary to immobilize the joint above and the joint below the fracture.

The reasons behind this principle are the following: (i) The activity of the patient permits of his general health being maintained to supply the necessary factors to aid union. (ii) The activity of the limb involved permits of (*a*) the active contraction of the muscles in relation to the fracture, so keeping the tone in them, (*b*) the maintenance of a full blood supply to the limb, hence to the site of fracture, so bringing all the necessary products to the site, and (*c*) the removal of waste products from the site around the fracture, so reducing the amount of fibroblast invasion and therefore subsequent fibrous tissue formation which gives rise to adhesions, *et cetera*. This last applies particularly to fractures near joints, where the fibrous tissue contraction results in such stiffening of the capsule of the joint that a long period of exercises and manipulation associated with pain follows before these periarticular adhesions are broken down.

Tendons are usually protected by their synovial sheaths so that they lie free in them and are not involved in the fibrous reaction about a fracture; but if the tendon sheath is involved and fibrosis begins between the tendon sheath and the tendon, the movement of the tendon in its sheath prevents adhesion between them and maintains that tendon's action.

Reduction is recognized as being achieved, firstly, by complete mobilization of the fracture, for any attempt to reduce the fracture without disimpaction or without freeing the bones of interlocking spicules prevents traction and manipulation from being effective; secondly, relaxation of the muscles and tendons in relation to the fracture. Nowhere is this illustrated better than in fracture-dislocation of the ankle. Difficult reduction is made easier, or reduction previously impossible is made really easy, by relaxation of the *tendo Achillis*—that is, by bending the knee to relax the calf muscles, or in other words, by performing reduction with the patient lying down with the knee bent over the end of the table and the toes of the foot resting upon the surgeon's knee as he sits to perform the reduction.

In the reduction and fixation of the fracture the rule is to bring the distal fragment into line with the upper fragment. This is done by traction, which overcomes the shortening that may be present, so that the two fragments can then be easily manipulated to lie in the correct position.

The preliminary traction may be so negligible as to be included in the one manœuvre of manipulation, or it may need to be continued for a matter of twenty minutes or more by a relay of assistants. In extreme cases the traction may need to be skeletal in type before manipulation can be successfully performed.

The question of continuation of traction after reduction of the fracture depends entirely on the type of fracture present. Whereas, previously, failure to secure immobilization was the main cause of non-union, in that the movement broke the fine capillaries as soon as they attempted to establish themselves between the two fragments, one of the main causes of non-union in modern methods is separation of the fragments as a result of traction. This is aggravated in the case of fracture of the

tibia and fibula by the use of certain types of frames.

Failed immobilization of the fracture as a cause of non-union so caught the attention that methods of fixing the lower fragments were devised. The use of a frame with skeletal traction was found to fix the lower fragment perfectly, to permit partial flexion of the knee, and to make the patient comfortable in the bed and easy to nurse. While the frame securely immobilized the lower fragment it permitted movement of the upper fragment with any movement of the body, so there was a possibility of delayed union being aggravated. This is more a theoretical than a practical objection. The thigh can be bound to the splint so that the splint and thigh move as one during nursing, and there is thus no movement of the site of fracture. This makes it an ideal splint for the handling of fractures of the tibia and fibula.

The decision to use traction after reduction should be made according to whether it is necessary to keep traction to maintain reduction.

In the case of transverse fractures there is a small area of exposed surface of bone, usually in a part of the bone with poor blood supply, such as the shaft. Hence there is a minimal amount of surface to supply those products necessary for the formation of callus. The danger in these fractures, therefore, is delayed union or non-union. Once reduction has been achieved, so long as the fragments are supported on either side to prevent angulation, rotation or lateral displacement, the fragments should stay in position. If the fragments are allowed to come together the spasm of the muscles playing over the site of fracture will help impact them and so aid union by holding them firmly together in a longitudinal direction. There is no danger of shortening with the two ends of the bone brought together as in their normal state. Therefore, in these fractures one is not concerned with any risk of shortening, but with the risk of non-union; hence everything should be done to overcome the latter possibility. Thus in transverse fractures, after reduction, splints and supports should be supplied to prevent the fragments from being redisplaced by the application of side supports; and longitudinal traction is not only not indicated, but is definitely contraindicated.

In oblique fractures, however, it is found that the conditions are almost the opposite. The fracture line is long, exposing two large raw areas of bone, so that one is not faced with the difficulty of obtaining union, but with that of keeping the bone surfaces together. As the fracture is oblique, the spasm of the muscles will pull the distal fragment proximally; hence shortening is certain, unless something is done to prevent it.

In this case, one is concerned with the shortening of the bone, as union is certain with normal precautions, so that traction must be applied. The traction may be mobile or fixed; skeletal traction or skin traction may be used. One variety of fixed traction used now in the zeal to have the patient out of bed (not necessarily with a walking iron or other such appliance) is to insert wires through either end of the affected bone and to incorporate these in a plaster cast with traction maintained; then, when the plaster has set, to allow it to perform the double function of preventing later displacement and, by fixing the pins, of acting as fixed traction to the fracture. This seems an excellent idea and serves the purpose well.

The advantage of this method is that it permits of the patient leaving his bed; it facilitates nursing and reduces the length of stay in hospital; and in a number of cases it allows a patient to follow his occupation after a break of a couple of days only, instead of after two or three months.

In these methods I am not advocating the use of walking irons fitted to plaster casts. I think there is a definite place for their use in fractures of the ankle, and I use them often; but men who have had a far greater experience of fractures than myself and for whose opinion I have the greatest respect are very resistant to their use. One such senior man has been known to repeat that "it is only over my dead body that a patient of mine shall leave this hospital wearing a walking iron". The reason for the failure of walking irons in fracture of the leg lies in the fact that the plaster cast does not grip the limb securely enough to prevent slight rotations of the upper fragment, and these subject the callus to repeated torsions. These torsions result in interference with callus formation and are therefore one of the most potent factors in causing non-union.

The advantage of walking irons is that they stimulate union of the fracture, for besides the benefits that they provide, as laid down before, in the free mobilization of the patient, the jarring at the site of the fracture that accompanies walking stimulates union. This longitudinal jarring at the site of fracture is one of the methods laid down in the treatment of non-union of fractures.

Böhler, in his book on the treatment of fractures, has introduced relatively little that is new in actual treatment, but has brought together the methods of handling the different individual fractures. Where he has achieved something outstanding, however, is in pointing out the importance in the treatment of fractures of efficient and sufficient immobilization of the fractured limb with activity of the patient. Similarly, in his principles of treatment of compound fractures and traumatic wounds as a whole, the whole secret of success lies in absolute immobilization of the part and the patient. When these two great principles have been appreciated, the rest of his book takes the form of a text-book on the routine treatment of fractures.

The method of treatment of fractures of the surgical neck of the humerus, as suggested, has been evolved with strict obedience to the principles of treatment of a fracture, as mentioned above. The treatment laid down by Böhler, which has been accepted along with the rest of his dicta, has been evolved from the same principles, but with a slightly different conception of the fundamental condition.

The method I am advocating is not a new method by any means; it has been used by one of the surgeons at the Royal Northern Hospital, London, for at least five years, though he would not lay down definite rules and reasons for his use of the method. I first saw the method used by Mr. Brockman and Mr. Rundle at the Westminister Hospital.

The actual method of treatment is as follows. After a routine examination has been made for complications and a radiographic examination has confirmed the diagnosis, the patient is put to bed in the full Fowler's position, with a cuff and collar sling only; the arm is allowed to hang by the side with the hand almost up to the throat. On the second day massage to the shoulder about the fracture is begun; the masseur concentrates on the supraspinatus and deltoid muscles to overcome the spasm and œdema of these muscles. It is essentially gentle, but thorough and penetrating through the depth of the muscle. Massage is carried out twice or three times a day. The patient is allowed up on the fourth day, or quite often he is not confined to his bed at all, particularly when he is a public hospital patient. On the fifth to seventh day active movement of the shoulder is carried out with the aid and careful cooperation of the masseur. With the patient lying flat and the weight of the arm taken by the masseur, the shoulder is put through a full range of active movement after the period of massage. This massage followed by active movement is then continued daily.

Union is checked by radiographic examinations, but usually it is clinically sound enough by the third week to permit the patient to dress and then to have the arm in the cuff and collar outside his clothes. By about the third week the patient is able to carry out a full range of movement unassisted. According to radiological evidence of union, the sling is discarded and light work with the arm is done.

In the adoption of this method of treatment various factors are considered. The method ignores the idea of absolute immobilization of the fractured limb; but it does not ignore the principle of sufficient and efficient immobilization of the fractured limb. The arm hangs comfortably by the side, and with the big mass of muscle about it, it is well protected. Moreover, the fracture is not truly transverse, but more oblique; and it is through the vascular part of bone, so that non-union practically never occurs at this site. The joint above the fracture and the elbow are held fixed in a position of relaxation, the arm hangs by the side, the wrist is held by a cuff and collar and the elbow is fully flexed.

Reduction is secured in this type of fracture by traction of the weight of the arm; this brings the upper fragment into line with the lower fragment and holds it there by the splint action of the deltoid muscle. Relaxation of the controlling muscles is secured by massage. The spasm of the supraspinatus muscle is responsible for the abduction of the fragment; by massage this spasm is overcome. It is easier in this case to bring the upper fragment into line with the lower fragment. Traction is continued, for it helps to maintain a comfortable and secure position for fixation of the fracture.

The fracture site becomes "sticky" in a few days, so that there is no great danger of upsetting the fracture by early movement. The weight of the arm is taken by the masseur, and coordinated contraction of antagonistic muscles of the shoulder is carried out. This movement brings an increased blood supply to the fracture and the muscles about it, so helping in the removal of the waste products and œdema and preventing periarticular adhesions, besides keeping a full range of movement of the shoulder. If the masseur cooperates the risk of non-union is not increased, as the pain of attempted movement without the cooperation of masseur, patient and muscles about the fracture will call a halt to the proceedings.

Non-union, however, is not the main fear with this fracture, but inability to abduct the arm. In this method of treatment abduction and rotation are maintained right from the end of the first week. One must have a most enthusiastic, patient and understanding masseur to assist, for the whole secret of success lies with him.

As an alternative to this method there is the aeroplane splint with or without traction. Against this method is the difficulty in the fitting of the splint, to say nothing of the wearing of it; some, however, have managed to make the fitting a fine art. The splint tends to move on the patient in bed, or while he is walking amongst people or through doors *et cetera*; moreover, the arm is acting as a support for the splint instead of the splint for the arm, and this results in separation of the fragments with abduction angulation. The curse of wearing this splint is verified by anyone who has had to wear it. Sometimes, when traction is necessary, the aeroplane splint is used with the patient in bed, and after about a fortnight the patient is allowed up, wearing cuff and collar or sling only. Also, if such a complication as injury to the axillary nerve occurs, as shown by loss of sensation over the deltoid muscle, then the aeroplane splint is invaluable and has to be used.

In impacted fractures in elderly people the patient is allowed and encouraged to move the limb through the full range of movement from the start, resting it in a sling till union is complete. In younger people, the fracture is disimpacted and then treated by the method described above.

The aeroplane splint is still widely used (not in orthopædic clinics as a whole) as a means of ambulatory treatment; but in view of the success achieved by the use of the cuff and collar combined with active movement for both abduction and adduction fractures, the comfort of the patient under treatment, and the reduction in the amount of time required for bed treatment, it is the better method.

# STUDIES IN TUBERCULOSIS. V: THE INTENSITY OF THE TUBERCULIN REACTION AND ITS RELATIONSHIP TO THE FREQUENCY OF RADIOLOGICALLY RECOGNIZABLE TUBERCULOSIS IN APPARENTLY HEALTHY YOUNG ADULTS.[1]

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IT may be stated at once that in persons reacting to the Mantoux test the intensity of the reaction is of no absolute diagnostic significance, since, when a constant amount of tuberculin is injected, reactions of any degree of intensity, from the sharpest to the least, may occur in persons suffering from tuberculosis, just as in persons presenting no clinical or radiological evidence of tuberculosis. The factors governing the intensity of the reaction have so far eluded exact definition.

Nevertheless, during the past thirty years many experimenters have sought to use the intensity of the reaction as the yardstick in tuberculin tests intended to be quantitative as well as qualitative. It is clear that there are several ways in which such tests could be made. For instance, the sensitiveness of the reactor could be determined by finding the weakest solution of tuberculin which would cause a reaction of a certain degree of intensity when a constant volume was injected; and Atsatt,[1] Blair and Galland,[2] King[3] and others, building on the work of White and Graham,[4] have devised and used a "differential quantitative tuberculin reaction" and have determined upon a "threshold dilution" of tuberculin, which, they have stated, will produce reactions in a large proportion of persons suffering from active tuberculosis, but in few persons not so suffering. However, in 1931 Schwartz and Heise[5] found that such tests gave them no conclusive evidence regarding the lesion present in persons ill with tuberculosis. Conversely, the dimensions and intensity of the reactions to constant volumes of the solutions of tuberculin commonly employed for the qualitative Mantoux test could be measured and correlated with the state of health and the X-ray appearances of the lungs of the subjects. In 1926 Opie and McPhedran[6] reported that "increasing intensity of reaction is associated with a gradually mounting frequency of recognizable tuberculous lesions", and that "the probability of grave infection increases with the severity of the tuberculin reaction". In 1929 Hetherington, McPhedran, Landis and Opie[7] reported the application of the Mantoux test to 2,126 school children, who were also examined radiologically in Philadelphia. Reactors to a dose of 0·01 milligramme (American notation) of tuberculin presented X-ray appearances diagnosed as tuberculous much more frequently than those who reacted only when ten or one hundred times this dose was administered. In 1936 Wells and Smith[8] published similar findings in a series of nearly 5,000 examinations. In 1929 Dickey[9] measured the size of the reacting area in some 700 children who reacted to a single injection of 0·1 cubic centimetre of a 1 in 1,000 dilution of old tuberculin. He found that there was very little difference in the average size of the reactions of children who did and children who did not present X-ray appearances attributable to tuberculosis. He found that large reactions occurred in phlyctenular conjunctivitis and in osseous and lymphoglandular tuberculosis, but he could not find a relationship between the size of the reaction and activity of the disease. In 1934 Johnston, Howard and Maroney[10] expressed the opinion that in tuberculosis of childhood maximum sensitiveness corresponded to maximum lymphoglandular involvement.

It is noteworthy that in all these investigations the subjects were children, and that mostly they lived in places where tuberculosis is much more prevalent than in Australia. It is also noteworthy that all the authors reckoned as tuberculous for statistical purposes a variety of common radiographic appearances, minute spots and localized faint strand-like markings, which, though doubtless in many cases shadows cast by the vestiges of tuberculous processes, are of little or no practical significance. Indeed, if others were to imitate the American authorities in this respect without having the advantage of the most modern high-powered X-ray equipment, it is possible that statistics would be produced marred by the misinterpretation of the shadows of pulmonary blood vessels as latent or calcified tuberculous processes, for there are resemblances between the two.

### Present Study.

It was my impression, formed clinically after the adoption of a technique[11] for the Mantoux test employing a single injection of only 0·025 cubic centimetre of the usual second-strength solution of the purified protein derivative of tuberculin, that in apparently healthy young adults with no family history of tuberculosis certain kinds of reaction to the injection were relatively frequently associated with radiographic evidence of latent or active tuberculosis. With this technique the large reactions to the doses of 0·1 cubic centimetre of the standard American technique are seldom seen; vesicular reactions and sharp reactions are more frequent, but very seldom large enough to be inconvenient. It is, of course, very much simpler to compare the intensity of reactions to a single injection than to compare the intensity of reactions to a test comprising two or more injections.

In order to test this impression X-ray examinations have been made of some 300 apparently healthy young adults who received the single test injection of tuberculin, and the results are set out in Tables I, II and III. The results show that in apparently healthy young adults reaction to the test with ecchymosis or vesiculation was relatively frequently associated with radiological evidence of

[1] Work carried out with the aid of a grant from the National Health and Medical Research Council of the Commonwealth of Australia. From the Royal North Shore Hospital of Sydney Institute of Medical Research.

TABLE I.

*The X-ray Appearances of the Lungs of 312 Apparently Healthy Young Adults Reacting with Different Degrees of Intensity to the Intracutaneous Tuberculin Test.*

| Appearances. | Non-Reactors. | Reactors. | | | |
|---|---|---|---|---|---|
| | | Number in Whom the Raised Area of the Reaction did Not Exceed 10 mm. in Diameter. | Number in Whom the Raised Area of the Reaction was Between 10 and 15 mm. in Diameter. | Number in Whom the Raised Area of the Reaction was Between 15 and 20 mm. in Diameter. | Number Who Presented Ecchymotic or Vesicular Reactions. |
| *Non-tuberculous:* | | | | | |
| Lungs radiographically normal | 59 | 80 | 32 | 20 | 7 |
| Pulmonary venous congestion, cardiac abnormality, bronchiectasis, bronchitis and the like | 3 | 4 | 2 | 0 | 2 |
| *Presumably non-tuberculous:* | | | | | |
| Localized faint strand-like markings | 2 | 6 | 7 | 1 | 2 |
| Minute spots | 7 | 17 | 6 | 0 | 0 |
| *Possibly due to vestiges of tuberculosis:* | | | | | |
| Peaking of diaphragm or thickened pleura | 5 | 5 | 3 | 0 | 2 |
| Shadows undoubtedly due to nodules of calcification | 1 | 10 | 2 | 3 | 7 |
| Sharp heavy bronchial shadows with or without calcification | 0 | 2 | 0 | 3 | 1 |
| *Tuberculous:* | | | | | |
| Parenchymatous infiltration almost certainly inactive, but potentially progressive tuberculosis | 0 | 2 | 5 | 0 | 0 |
| Infiltration almost certainly active tuberculosis | 0 | 1 | 0 | 2 | 0 |
| Total | 77 | 127 | 57 | 29 | 22 |

TABLE II.

*Condensation of Table I.*

| Intensity of Reaction. | Number of Subjects. | X-ray Appearances. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Non-tuberculous. | | Presumably Non-tuberculous. | | Possibly due to Vestiges of Tuberculosis. | | Tuberculous. | |
| | | Number. | Percentage. | Number. | Percentage. | Number. | Percentage. | Number. | Percentage. |
| No reaction | 77 | 62 | 80·5 | 9 | 11·7 | 6 | 7·8 | 0 | 0·0 |
| Raised area less than 10 millimetres in diameter | 127 | 84 | 65·6 | 23 | 21·1 | 17 | 14·1 | 3 | 2·3 |
| Raised area between 10 and 15 millimetres in diameter | 57 | 34 | 59·6 | 13 | 22·8 | 5 | 8·8 | 5 | 8·8 |
| Raised area greater than 15 millimetres in diameter | 29 | 20 | 68·9 | 1 | 3·4 | 6 | 20·7 | 2 | 6·9 |
| Ecchymosis or vesiculation | 22 | 10 | 45·5 | 2 | 9·0 | 10 | 45·5 | 0 | 0·0 |

TABLE III.

*Another Condensation of Table I.*

| Intensity of Reaction. | Number of Subjects. | X-ray Appearances. | | | | | |
|---|---|---|---|---|---|---|---|
| | | Non-tuberculous or Presumably Non-tuberculous. | | Showing Abnormality Referable to the Pleura Only. | | Showing Tuberculosis, Calcified, Latent or Active. | |
| | | Number. | Percentage. | Number. | Percentage. | Number. | Percentage. |
| No reaction | 77 | 71 | 92·2 | 5 | 6·5 | 1 | 1·3 |
| Raised area less than 10 millimetres in diameter | 127 | 107 | 84·3 | 5 | 3·9 | 15 | 11·8 |
| Raised area between 10 and 15 millimetres in diameter | 57 | 47 | 82·5 | 3 | 5·3 | 7 | 12·3 |
| Raised area greater than 15 millimetres in diameter | 29 | 21 | 72·4 | 0 | 0·0 | 8 | 27·6 |
| Ecchymosis or vesiculation | 22 | 12 | 54·5 | 2 | 9·1 | 8 | 36·4 |

former tracheo-bronchial lymphoglandular tuberculosis, and that reaction with a raised area greater than ten millimetres in diameter was relatively frequently associated with radiological evidence of tuberculous processes, latent or active, in the pulmonary parenchyma; also that in apparently healthy young adults with no family history of tuberculosis who reacted weakly to the test, radiological evidence of such processes was relatively uncommon.

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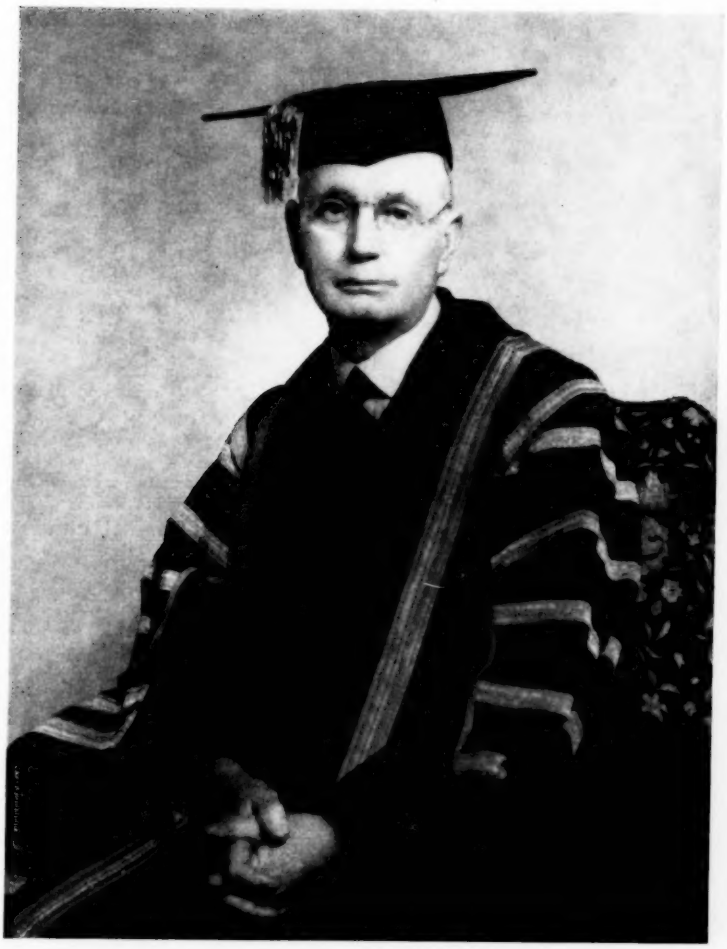

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## SOME PHYSIOLOGICAL EFFECTS OF HEAT AND LIGHT.

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DIATHERMY, inductothermy and short-wave therapy all produce the same physiological effects, which are due solely to heat. Before the days of the inductotherm and short-wave machines some users of long-wave diathermy maintained that there was a mysterious electrical effect on tissue; but they could never run it to earth and there was never any proof of any effect other than heat. When short-wave therapy came into vogue some Continental experimenters claimed that various wave-lengths had a specific effect on organisms; but no independent investigators have been able to reproduce the findings claimed, and it can be said now that there is no proof and little probability of short-wave therapy producing any effects on tissue other than those due to heat. So the decision whether to use diathermy, inductothermy or short-wave therapy in any given case depends on which type of current will most efficiently produce heat at the desired spot.

The effects of heat in the body are many; the most obvious and the most important is hyperæmia, and the power to cause hyperæmia at any given spot is the power to modify profoundly the physiological state of that spot; for increased blood supply means increase of leucocytes, increased oxygen, increased cellular activity—in other words, increase of all the factors that make for repair of damaged tissue or increase the activity of normal tissue. Moreover, all chemical activity is helped by a rise of temperature, so that the chemistry of cellular exchange is speeded up. There is a soothing effect on sensory nerve endings, which results in relief of pain; there is also a relaxation of muscular spasm, which probably accounts for the fall in blood pressure in arteriosclerosis when general diathermy is given. This fall is often as much as 30 millimetres of mercury (systolic) and 15 millimetres (diastolic), and when one begins to treat a patient suffering from high blood pressure by general diathermy care must be taken not to achieve too drastic an effect.

### Infra-Red Radiation.

Infra-red radiation also depends on heat for its beneficial action; the short rays, from 7,700 to 12,000 Ångström units, probably penetrate to the superficial fascia, but may affect more deeply lying tissues, either by the heated blood stream or by reflex action. Rays with wave-lengths above 12,000 Ångström units are absorbed by the superficial layers of the epidermis, and that fact may account for the generally held opinion that the luminous burner (that is, one giving infra-red rays combined with luminous rays) is more efficient than the burner that gives a pure infra-red ray, for the visible rays also towards the red end of the spectrum (5,000 to 7,700 Ångström units) pass through the skin and produce heat; so that the spectral range of a luminous burner will be from, say, 5,000 to 18,000 Ångström units, and of these all the rays up to a wave-length of 12,000 Ångström units will penetrate deeply; while with a pure infra-red burner giving off rays up to perhaps 30,000 Ångström units, a much smaller proportion will penetrate beyond the superficial epidermis.

When general infra-red radiation is used—that is, when a large part of the abdomen and chest is exposed to irradiation—I have noticed very interesting physiological effects in surgical shock (I was by the bedside and saw the effects myself). These were as follows:

Relief of Pain. Within a few minutes after the lamp was lit pain was considerably eased.

Improvement of Colour. The face was completely shaded from the lamp; yet in a few minutes the complexion changed from a leaden grey to a healthy pink. This must have been due to a general improvement of the circulation.

The Pulse. The pulse rate slowed down from 96 to 84 per minute and the quality of the pulse improved.

Sleep. On three successive occasions the patient was asleep within a quarter of an hour after the lamp was turned on.

### Artificial Fever.

When artificial fever is produced by external heat—for example, hot baths or air-conditioned cabinets—the temperature of the skin rises above the internal temperature. But when penetrating heat is used—for example, diathermy or the inductotherm cabinet—although the skin is heated by the dilatation of the capillaries in their attempt to cool the body, its temperature does not rise above the internal temperature, even in the early phase

of heat production, and later the original difference of about 2·5° C. is reestablished.

This has a practical importance, as it has been found by experiment that heating of the skin may cause a rise in the pulse rate up to 30 beats per minute before the body temperature is affected; so if undue heating of the skin can be avoided while artificial fever is being produced, there will be less rise in pulse rate—in other words, less strain on the organism.

It is found that the greatest disturbance in the pulse rate is caused by heating baths, less by air-conditioning, still less by radiant heat cabinets, and least of all by penetrating heat. If the last-mentioned is used in an air-conditioned cabinet, the increase in pulse rate should not be more than six beats per minute for every rise of 0·55° C. in body temperature. It is interesting to recall in this respect the death of a child in Auckland about three years ago while artificial fever was being produced by means of a hot bath.

The mere retention of the heat developed by metabolism, if the subject is placed in an insulated bag, will cause a rise of body temperature of from 1° to 1·7° C. in three hours.

The effect on blood pressure is usually a rise in the systolic and a fall in the diastolic pressure, so that readings of 160 millimetres of mercury systolic and 0 diastolic are likely to occur when the patients have a normal circulatory system. Doubtless the rise in the systolic pressure is due to the increased heart action, and the fall in diastolic pressure to the dilatation of peripheral vessels; for the same reasons the velocity of the blood flow is increased.

During the average fever treatment there is profuse sweating, so that in an eight-hour period a patient would be likely to lose at least 2·2 kilograms in weight, in spite of copious drinking. The fluid lost by sweating would be about 4,500 cubic centimetres, with 45 grammes of sodium chloride and a fair amount of urea and lactic acid. The importance of the sodium chloride loss is the risk of heat stroke unless the intake has been increased previously and saline solution is drunk freely during the treatment.

The blood volume, of course, is decreased. The amount has not been measured in man, but in animals it reaches as much as 25%. There is an increase of 1,000,000 red cells and of 3,000 to 6,500 white cells per cubic millimetre. The increase in the red cells is due to the greater concentration of the blood; but that of the white cells is largely due to the stimulation of the hæmatopoietic system. The increase is gradual, reaching its maximum in about four hours and declining to normal again in from twenty-four to forty-eight hours; it is confined to the polymorphonuclear cells, and there is usually a decrease in the lymphocytes.

At temperatures of 38·5° to 39° C. there are a slight increase in the plasma pH and a decrease of from four to twelve volumes *per centum* in the total carbon dioxide content of the blood. At higher temperatures there is a tendency to more pronounced acidosis, probably due to increased lactic acid formation. There is also a temporary increase in the non-protein nitrogen and the uric acid content of the blood.

The basal metabolic rate is also raised by about 7% for each increase of 0·55° C. in body temperature.

The effect of some drugs is considerably altered during the period of artificial fever. The most important alterations (from a practical standpoint) are the following: (i) hyoscine frequently causes prolonged delirium; (ii) adrenaline tends to produce a rise in temperature to a dangerous level; (iii) strychnine may cause convulsions with a consequent sharp rise in temperature; (iv) atropine, by its usual action of lessening perspiration, may increase temperature to an undesirable height.

### Ultra-Violet Radiation.

The wave-length of medical ultra-violet rays is from 1,849 to 3,900 Ångström units, and, as with infra-red rays, different wave-lengths have different effects. Rays from 1,849 to 2,900 Ångström units are absorbed in the superficial epidermis and are abiotic in action. Rays from 2,900 to 3,300 Ångström units are absorbed in the deep epidermis and cause pigmentation. As ordinary glass absorbs rays shorter than 3,300 Ångström units, sun shining through it causes no pigmentation. "Vita-glass" will allow the passage of rays down to 2,750 Ångström units, so that it does not prevent pigmentation. Rays from 3,300 to 3,900 Ångström units are absorbed by the blood of the capillary loops in the dermis.

Ultra-violet erythema is caused by rays of 2,500 to 3,100 Ångström units and appears in from four to eight hours; if it is pronounced, destruction of cells will occur, with the production of the so-called H-substance, which is closely related to histamine and causes dilatation of blood vessels. If the erythema is considerable there will be exudation of fluid and white corpuscles into the skin, resulting in œdema or blister formation, according to degree. With a third-degree erythema the surface layers will peel, which accounts for some of the benefit received in suitable cases of acne and psoriasis.

Pigmentation is caused by the production of melanin in the deep layers of the epidermis, and opinions vary as to its benefit. Rollier thinks that those patients do best who become pigmented easily, while many now try to avoid deep pigmentation.

The rays of longer wave-lengths, termed biotic rays, stimulate cell growth and so help in the healing of wounds and ulcers.

The erythema, which is much more prolonged than that caused by diathermy or infra-red rays, lasting up to several days in the third degree, brings, of course, all the physiological benefits of increased blood supply.

The short rays (1,849 to 2,900 Ångström units), owing to their abiotic action, destroy organisms in the superficial layers of the skin. The fatty secretion of the sebaceous glands contains cholesterol, with its impurity ergosterol, which, under

the action of ultra-violet rays, is changed into vitamin *D*; it is this production of vitamin *D* in the skin that helps in the absorption of calcium and phosphorus from the intestines and so increases the blood calcium and phosphorus levels.

There is also an increase in hæmoglobin content. A stimulating effect on the thyreoid gland with an increase of iodine in the blood is also experienced; hence the unwisdom of using ultra-violet rays in cases of toxic goitre. While ultra-violet radiation stimulates the thyreoid gland, it depresses the suprarenals, with a resulting fall in blood pressure.

It is a combination of all these actions which gives ultra-violet radiation its general tonic effect, with increased resistance to disease, improvement in appetite and sleep, and improved nutrition of muscles.

But in a few cases general ultra-violet irradiation, for a cause I have not seen explained, produces restlessness, sleeplessness, headache, and great nervous excitability.

One other important effect must be remembered when a course of ultra-violet irradiation is being begun with the object of increasing a patient's resistance to a chronic infection: if a commencement is made with too large a dose the result may be the production of a severe negative phase and a flare-up of infection. This sudden depression of resistance following too long an exposure to ultra-violet rays is almost certainly the cause of the sudden flare-up of a latent pulmonary tuberculosis that one sees happen every now and again after prolonged sun-baking.

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## Reports of Cases.

### RAPIDLY GROWING FIBROSARCOMA OF THE UTERUS TREATED BY DEEP X-RAY THERAPY.

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#### Clinical Record.

A MARRIED woman, aged thirty years, was transferred from the Royal Hospital for Women to the Prince Henry Hospital, Sydney, on April 11, 1939, for the administration of deep X-ray therapy for an advanced fibrosarcoma of the uterus.

The patient, who is a Czech and a strong agricultural type, had consulted Dr. F. Brown Craig on December 13, 1938. She had a baby, aged four months, which she was feeding at the breast; and she said that immediately after her last confinement she had felt a hard lump in the lower region of her abdomen. At the end of the first month of this pregnancy she had complained of pressure and discomfort in the hypogastrium. The doctor attending her had thought that the pregnancy at this stage had advanced to four months.

When she first saw Dr. Brown Craig she complained of "feeling swollen" in the lower region of the abdomen. One menstrual period had occurred when the last child was one month old. On examination of the abdomen a prominent swelling in the suprapubic region could be seen extending upwards from the pelvis and to the right. Its highest limit was three inches above the *symphysis pubis*.

Examination *per vaginam* revealed a firm perineum. The cervix was pushed to the left of the mid-line, and the body of the uterus was enlarged by a tumour three inches in diameter in its wall, which filled up the right side of the pelvis. The consistency of the mass was softer than that of the usual fibroid tumour.

A provisional diagnosis of fibromyoma of the body of the uterus was made, and the patient was advised to come for operation a few months later, when the child had been weaned.

On February 10, 1939, she returned, in a condition of some alarm, as she felt more swollen than before. An examination showed that the cervix was patulous and that the mass was larger. She was admitted to the Royal Hospital for Women and was operated upon on March 7, 1939. Dr. Brown Craig's own account of the operative and subsequent findings is as follows:

> On opening the abdomen, to my amazement the uterus was found to be symmetrically enlarged to the size of a twenty weeks' pregnancy. No irregularity in its walls could be found, and its consistency was that of a pregnant uterus. To confirm the diagnosis of pregnancy an incision two inches long was made through the muscular wall of the uterus until what appeared to be decidua was encountered. After this discovery a cyst, one and a half inches in length, was excised from the right ovary and the abdomen closed. To clear up any doubt, an Aschheim-Zondek test was carried out. This was definitely negative. In the meantime active changes had been going on in the pelvis. The tumour had enlarged rapidly. Three weeks after the first operation I opened the abdomen again and was dismayed to find that an actively growing newgrowth, arising from the uterus, had already, in the short space of three weeks, invaded the abdominal wall on the right side of the incision. Removal of the tumour was impossible. Within two weeks a red actively growing new growth had forced the edges of the hypogastric incision apart and was appearing like a large mushroom above the level of the skin. The case was sent to Prince Henry Hospital for deep X-ray therapy.

A biopsy of the tumour had been made at the Royal Hospital for Women; and the report by the pathologist was as follows:

> Histologically the growth is a fibromyoma with many cellular areas showing rapid growth; but it does not show the typical appearances one associates with sarcomatous changes in a myoma. However, taken in association with the clinical history and rapid spread, one must consider it malignant.

Dr. A. H. Tebbutt agreed with the opinion that it was malignant on clinical rather than on histological grounds.

When the patient was examined at Prince Henry Hospital on April 11, 1939, there was a large mushroom-like fungating mass, thirteen centimetres in diameter, protruding from the abdominal incision. It was dark reddish

in colour, was raised considerably above the surrounding skin, and was of soft consistency. It had a most unpleasant odour, so that it was necessary to nurse the patient on the ward balcony. An X-ray examination of the chest on April 17, 1939, revealed no evidence of metastases.

Deep X-ray therapy was commenced on April 12 and continued daily (with the exception of week-ends) till April 28, 1939. Two fields were used, each 20 by 20 centimetres in area, one anterior field over the lower portion of the abdomen and the pelvis, the other posteriorly at a corresponding level. The dose was 2,400 *r* to each field, and the daily dose was 400 *r*. The kilovoltage was 300, the milliamperage was 10 and the filtration was three millimetres of copper *plus* one millimetre of aluminium.

The patient was later discharged from hospital. When she was seen again on June 28, 1939, the malignant mass was considerably smaller and the foul odour had gone; but there was still an area of fungation at the centre of the scar. Further deep X-ray therapy was therefore prescribed. Two fields were again used; but the area of each field was made 10 by 15 centimetres. The dose was 2,400 *r* to each field and the daily dose was 400 *r*. The other factors were the same as before.

On August 16 there was considerable improvement; the fungating mass had been replaced by a flat ulcerated area, four and a half centimetres by three centimetres in area, which appeared to be healing. Slow healing followed over several weeks, and when the patient was again seen on November 8 the abdominal incision was healed, a circular soft scar replacing the previous malignant growth. Examination *per vaginam* revealed remarkable improvement. The general condition of the patient was now good and her weight was increasing.

She was seen again by Dr. Brown Craig on March 7, 1940, and the following is his report of that examination:

> Patient is in excellent condition. The abdomen where the sarcoma had appeared between the edges of the hypogastric incision is now represented by a cicatrix two inches long by one and a half inches broad. There is no impulse on coughing. *Per vaginam* the cervix is small, two and a half inches from the orifice, post-axial and mobile. The uterus is represented by an atrophic remnant about one and a half inches by one inch. This appears loosely attached to the abdominal scar. No ovaries can be demonstrated.

### Discussion.

This case is of interest from two aspects: first, the excellent result obtained in what at first appeared to be a hopeless condition; and secondly, the pronounced radiosensitivity of a rapidly growing fibrosarcoma.

Desjardins,[1] in discussing his classification of tumours from the standpoint of radio-sensitivity, states that fibrosarcomata are usually relatively radio-resistant; but this "does not necessarily mean that it is useless to attempt to treat them". He points out that sometimes a considerable degree of regression may follow exposure of one of these tumours to multiple beams of X rays or to a large dose of radium; but complete regression is exceptional. It would seem likely that in the above case complete regression has been obtained.

### Acknowledgement.

I wish to thank Dr. Brown Craig for kindly furnishing me with details of the history, clinical signs and operative findings in this case, prior to the patient's coming under my care, and for his report on her present condition.

### Reference.

[1] A. U. Desjardins: "A Classification of Tumours from the Standpoint of Radiosensitiveness", *American Journal of Roentgenology and Radium Therapy*, Volume XXXII, Number 4, October, 1934, page 493.

## Reviews.

### FRACTURES AND JOINT INJURIES.

THERE have been many books on fractures and joint injuries. They improve every year, increasing real knowledge, improving technique, shortening incapacity, bettering the final result, and so adding to the wealth and happiness of the community. The most recent is a fine volume by R. Watson-Jones, with the title "Fractures and Other Bone and Joint Injuries".[1] The book is a credit to its author, to its school, and to British surgery. It will be recognized as the best book on the subject that England has produced, and one of the best produced anywhere. We have read it through and have found it full of interest, full of careful thought, and full of practical experience. It is not possible to say roundly that any single book is in all parts consistently better than the rest. Able men, writing from broad-based experience, do not always agree as to what is the real explanation of every condition or complication, nor can they agree as to what is the best technique. What is the best in one way may not be the best in all ways, and compromises are necessary. Expert men seem to get good results with very different equipment, comfortably or otherwise. We ourselves confess that, with all our appreciation, we should not care to be Watson-Jones's patient in all conditions. For example, we think he could do much better with some other forms of treatment in the lower limb, especially for the femur. And we should like to hear his opinion of the Jones abduction frame after he had had a term in it himself as patient. It may suffice for small children, but for adults it is not only horribly uncomfortable, but also relatively inefficient.

We note that Watson-Jones uses what he still calls the "Thomas" knee splint (see page 513), but after abandoning the Thomas principle and converting it into a Hodgen. He retains a ring, making the splint look like a Thomas, but he pulls it away from the pelvis by what he calls "balanced traction". This is the Hodgen principle. Overhead suspension was used before Hodgen, but it was Hodgen who used the splint for traction. Why not give J. T. Hodgen (1826-1882) the tardy credit that is his due? He mentions the Hodgen splint once, cursorily, on page 135. Our author has no use whatever for overhead frames. All his methods are associated with bed splints or bed frames. Those surgeons who have extended experience with overhead frames ever since the Great War will be reluctant to return to bed splints, and so will the nurses. Plaster of Paris is used in almost all circumstances, whenever possible. It is consistent with this that in open fractures and wounds the author advocates exclusively the Winnett-Orr system of dressing, and finds no use for Carrel-Dakin treatment, which he scarcely mentions. Plaster of Paris does not go with Carrel-Dakin treatment. Yet it is not enough merely to wave away such a well-proved limb-saver as the Carrel-Dakin treatment. Our author has still something to learn about open fractures.

In Chapter 31, on injuries of the leg, he advises that when traction is to be applied, a transfixion pin should be passed through the tibia one inch above the ankle joint, and he deprecates traction by transfixion of the *os calcis*. Yet every illustration of traction in this chapter shows transfixion of the *os calcis*, and no transfixion of the tibia.

While in certain selected cases manipulation of joints is recommended, the author condemns the existing vogue of passive movement of limbs, as commonly useless, and often very harmful. Nor has he any more use for the massage play that now soothes the mind of doctors and patients. On the other hand, he puts great importance on voluntary exercise of muscles. This is in agreement with the great majority of thoughtful and experienced surgeons. In this connexion let us also quote the final paragraph of the book, for it is full of wisdom.

[1] "Fractures and Other Bone and Joint Injuries", by R. Watson-Jones, B.Sc., M.Ch.Orth., F.R.C.S.; 1940. Edinburgh: E. and S. Livingstone. Super royal 8vo, pp. 735, with 1040 photographs, X rays and diagrams. Price: 50s. net.

*Rehabilitation department*—Treatment is not completed until the patient himself recognises the functional recovery and regains full confidence in the limb. The exercises of a fracture department minimise joint stiffness and muscle wasting, but can never reproduce the stresses of heavy manual labour, nor restore the confidence necessary for work in precarious situations. The solution does not lie with the provision of "light work". Light work is seldom available and the demands of industry are such that if it is available it cannot be graduated. It may even have the opposite effect to that which was intended, and serve only to remind a man of his incapacity. The solution lies in the establishment of rehabilitation centres where physical and mental redevelopment can be achieved by recreational activities and by skilfully controlled graduation of work. With the stimulating atmosphere of friendly rivalry, the enthusiasm of the crowd which contrasts so sharply with the helpless despair of the unguided individual, and with carefully graduated physical stresses, more can be done by a few weeks of rehabilitation treatment than by months of "light work", or years of massage.

With all of this we heartily concur. And yet at present we have a surplus of massage and passive movement—eyewash and delusion—and nothing, or almost nothing has been accomplished in the way of rehabilitation centres. Where the attempt has been made, it has not been supported. Such is fashion.

It is surprising to find that our author makes no reference whatever to fat embolism as a complication of fractures. Those who depend wholly on this book will not recognize it when they see it; yet it is a very serious complication. It is hard to believe that it never occurs in Liverpool.

In the discussion of pathological fractures, while various rare conditions are mentioned, no reference is made to hydatid disease of bone, notwithstanding that it concerns every practitioner working amongst the eight or nine millions of English-speaking people who inhabit Australia and New Zealand. In the same chapter no mention is made of the characteristic "square-ended" subtrochanteric fracture that is so common in the subjects of *osteitis fibrosa*.

There are some other criticisms. We think our author makes too little of the difficulties of many fractures—for one example, a bimalleolar fracture with vertical fracture and backward dislocation, of which some are easy to treat, and some will baffle anyone. He seems to suggest that difficulties and second-grade results are the consequences of inefficient treatment. Undoubtedly there is much inefficiency, but we do not believe that Mr. Watson-Jones has no imperfect results.

The book, by reason of implied suggestions, will be a godsend for the prosecution in malpraxis actions against medical men who have really done very well, considering the adversity of circumstances. Perfect results are not always to be commanded. But legal blackmailers welcome every suggestion that imperfect results are usually the result of poor treatment.

We hope our criticisms may be taken as constructive, for our opinion remains, after all, what we stated at the outset, that this book stands well in the first class of books on fractures.

## A TEXT-BOOK OF PHYSIOLOGY.

WHEN in 1937 the first edition of Best and Taylor's "Physiological Basis of Medical Practice" appeared it was soon realized by those competent to form a proper judgement that something very new and very useful had appeared in physiological teaching. The term "applied physiology" had already been employed, but the book in question rather suggested the glorified notes of a coach accustomed to train candidates for post-graduate diplomas, particularly the Fellowship of the Royal College of Surgeons. Here at last was a text-book of physiology which could serve as a link between laboratory and clinic. The authors are perfectly aware that physiology can be pursued as a pure science and that first-rate contributions have been made by men like Langley and Bayliss who had no medical training, and by others like Starling whose research activities were divorced geographically and spiritually from the hospital wards. But in their words: "The teacher of physiology in a medical school owes it to his students, whose ultimate interest, it must be conceded, is in the diagnosis and treatment of disease, to emphasize those aspects of the subject which will throw light on the disorders of function."

The present second edition is enlarged and improved and cannot fail to take its place in the opinion of many as the best text-book of physiology in the English or indeed any language.[1] Many readers of the first edition regretted that special sense had been omitted and could not as a consequence recommend the volume as a compendious text-book of physiology. The authors state that they have been prevailed upon to add a new section on this important aspect and their tone rather suggests that this addition was made reluctantly. They need have no misgivings, for special sense is here admirably presented and the value of the book is greatly increased thereby.

No less than fifteen chapters are devoted to the circulation of the blood and this large section many will regard as the best, for not only the pure physiology but the clinical bearings are dealt with in a masterly manner. This happy blending of the theoretical and the applied is, however, refreshingly obvious in all the other chapters.

Three departments of the science receive in our opinion scarcely adequate emphasis. The treatment of muscle is found under "Metabolism and Nutrition" and the description of the complex chemical changes is excellent, but there is no mention of the mechanical aspects of contraction. Possibly the authors might make the rejoinder that the time-honoured exercises on isometric and isotonic and superimposed contractions have no clinical significance. This may be true today, but may not be true tomorrow. In the second place, the description of reproduction is confined to the hormonal regulation to the total exclusion of all other aspects. Thirdly, there is astonishingly little space given to the secretion of milk and the nutritional significance of this fluid. These criticisms are given in no carping spirit, but in the hope that a fine book may become better still.

It may be mentioned in conclusion that the authors are connected with the University of Toronto. This Canadian origin accounts for the fact that whilst the North American contribution to physiology is dealt with comprehensively, there is full recognition of the commanding eminence of the British schools of research.

## A NEW TEXT-BOOK OF PATHOLOGY.

IN their preface to "Pathology: An Introduction to Medicine and Surgery", Professor J. Henry Dible and Professor Thomas B. Davie lay emphasis on the importance of a knowledge of the natural history of disease, which is the true pathology.[2] Morbid anatomy leads back, by seeking out the genesis of the lesions, to ætiology, and so the way is prepared to lead on to preventive medicine.

[1] "The Physiological Basis of Medical Practice: A University of Toronto Text in Applied Physiology", by C. H. Best, M.A., M.D., D.Sc., F.R.S., F.R.C.P. (Canada), and N. B. Taylor, M.D., F.R.S., F.R.C.P. (Canada), F.R.C.S., M.R.C.S., L.R.C.P.; Second Edition; 1939. London: Baillière, Tindall and Cox. Medium 8vo, pp. 1890, with 497 illustrations. Price: 55s. net.

[2] "Pathology: An Introduction to Medicine and Surgery", by J. H. Dible, M.B., F.R.C.P., and T. B. Davie, B.A., M.D., M.R.C.P.; 1939. London: J. and A. Churchill Limited. Super royal 8vo, pp. 941, with 374 illustrations, including 8 plates in colour. Price: 36s. net.

The authors follow this up in their first chapter by saying:

> Cultivate the habit of looking beneath the surface: collect and consider every symptom and finding and strive to correlate their anatomy and physiology into one pathological whole. Above all, do not neglect the fact which does not quite fit in. Remember that it must have a basis somewhere . . . For most diseased conditions there exists a single cause and a simple and connected series of consequences.

Though the book, they state, has been written for students, the above observations appeal to us all, and the contents of this text-book of pathology can be of much service to the general practitioner as well as to pathologists themselves.

The work is well illustrated, by 374 figures. Some of these are in colour and excellently reproduced; others are diagrams and well-executed drawings to give a clearer delineation of details. The majority are reproductions of photographs. All these are very helpful in getting a clear mental picture of the conditions portrayed. The subject matter, except that all descriptions of animal parasites are omitted and that there is no special description of gynæcological conditions, covers the usual ground of a work of this nature, though the approach is often from a different angle. In this way those with a previous knowledge of pathology get a better, so to speak, a stereoscopic, view of the matters dealt with, which is so helpful in building up a sound basis in pathology. At the same time the beginner will find this a very good text-book. Short historical accounts increase the interest of various sections, as for instance that on infection and disease, though surely "Gallileo" should be "Galileo". There are some useful figures illustrating inflammation. In the nomenclature of the tumours the term "Grawitz tumour" seems preferable to "hypernephroma", as being non-committal. In describing the blood groups we would have laid stress on using the terms *A*, *B*, *AB* and *O*, which must in the end be generally accepted, instead of giving pride of place to Moss's classification, even though this may be in conformity with general surgical practice in England. Discussion of the diseases due to bacteria and viruses follows, with accompanying accounts of the causative agents. Then comes the series of chapters dealing with the lesions of the various systems. Under "Respiratory System" is an excellent illustration of organizing pneumonia. The authors refer to this as a rare complication of pneumonia; but Australian experience is that it is not infrequently met with, demanding that its possible occurrence should be more often borne in mind by the physician. There is an excellent illustration in colour of the caecum and ascending colon in Shiga dysentery.

We have found much of stimulating interest in this text-book of pathology, and can recommend it not only to the student and the general practitioner, but to the specialist as well, be he surgeon or physician or pathologist.

## THE DIETETIC ROUTE TO HEALTH.

IN "The Wheel of Health" G. T. Wrench sets out on the dietetic route to the attainment of complete health.[1] Of all peoples in India, McCarrison selected as unsurpassed in physique and health and long life a small tribe, the Hunzas, who live in a mountain valley between the Hindu Kush and the Karakorams. He noted especially their buoyant "abdominal" health and freedom from dyspepsia, duodenal ulcer, appendicitis, cancer *et cetera*, so common in civilized peoples. He also found excellent physique in quite different races, the Sikh and the Pathan.

At Coonoor rats were used to test the diet and living conditions of various Indian peoples. The "hunzarized" rats, living on wholemeal wheat bread, fresh butter, sprouted pulse, fresh raw carrots, fresh raw cabbage, unboiled whole milk, a small weekly ration of meat and bones and abundant water, were singularly free from disease. Rats on faulty diets, customary in Bengal and Madras, present the reverse picture of widespread disease.

Wrench follows up these investigations by discussing in turn breast feeding, Hindhede's work in Denmark, diet in Iceland, the work of Mellanby and Orr, the experience of Papworth, of Deptford Nursery School, and M'Gonigle's report.

His main thesis is "the marriage of Agriculture and Health". He advocates the conservation of the soil and the "Wheel of Health"—the cycle of man to the soil, the soil to the plant, the plant to the man. He pleads for a thorough review of our own civilized diet and the adoption of a diet complete in natural foods.

His case is well put, and his presentation deserves a wide audience within and without the profession. Altogether it is a book worthy of the consideration and thought of everyone responsible more or less for the health of human beings.

[1] "The Wheel of Health", by G. T. Wrench, M.D.; 1938. London: The C. W. Daniel Company Limited. Demy 8vo, pp. 146. Price: 6s. net.

## AVIATION MEDICINE.

WITHOUT doubt the book on aviation medicine by Harry G. Armstrong, director of the American Aero Medical Research Laboratory, will take its place as a standard treatise on the subject.[1] The wide field of the diseases and disorders which are produced by, or which complicate the functioning of the human body in flight, is well covered, with the exception of the hygiene and quarantine aspects, which are treated inadequately. Specially good are those chapters dealing with the effects of altitude, speed and acceleration, and with orientation and equilibration. The author wisely emphasizes the fact that vestibular illusions, which are no more pathological than the common and well-known visual illusions, constitute a grave danger. "Normal pilots when coming out of a spin suffer an illusion of reversal of motion, and as a consequence frequently fall into a second spin with usually fatal results." The beginner must learn to ignore these illusions of reversal of motion and be guided by the information received from the instruments. This book is, we believe, the first dealing with the physiology of aviation in the English language which mentions the Coriolis force; but it is a bare mention and does give the important applications which we owe chiefly to Pohl, of Göttingen.

It would have been better had the pruning knife been used more freely by the author. It was hardly necessary for him to state that candidates for pilot service should be rejected if they have elephantiasis, Hodgkin's disease or hydrocephalus. Why did he not add leprosy and yaws when he was at it? About forty pages are devoted to the examination of the eye, and these cover the ordinary routine of the ophthalmological specialist. It would have been wiser to give a list of disqualifying conditions and to leave the diagnosis to the expert, for in ophthalmology a little learning can be dangerous. Some pages are given to the theory and to the author's experiments on animals indicating that tissue fluids would boil at an elevation of 63,000 feet. This is purely academic, for the human body cannot survive above 45,000 feet unless in a sealed cabin. Undue emphasis is also given to nitrogen embolism. A pilot rising from sea level to 18,000 feet undergoes a diminution of pressure equal to half an atmosphere; but a diver is subjected to a decompression of as much as ten atmospheres when coming to the surface of the sea. A singular omission is that no mention is made of the greatly increased ventilation of the antra and sinuses due to quick changes in altitude. A rapid dive means that nasal mucus is driven into these cavities with a force Nature never intended, and in consequence they are exposed to much greater risks of infection.

Each chapter ends with a list of references by no means comprehensive, but of text-book practicability. The printing is clear, but the paper is curiously uneven in quality; this, however, may have been unavoidable in the present circumstances.

[1] "Principles and Practice of Aviation Medicine", by H. G. Armstrong, B.S., M.D.; 1939. London: Baillière, Tindall and Cox. Medium 8vo, pp. 508, with illustrations. Price: 36s. net.

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## MAKING THINGS HAPPEN.

WHETHER he was a philosopher or a cynic is not clear, but there was once a man who said that he divided human beings into three classes: the first was a small group of those who made things happen; the second was a much larger group, consisting of those who watched things happen; the third included the overwhelming majority of men who had no idea what happened. This is worth thinking about at the present time, and we may all ask ourselves to which of the three groups we belong.

Every one in the community no doubt knows that the nation is at war, though from the bearing of many persons this might be doubted. It is quite true that many people do not know what is happening. They know that the British Commonwealth of Nations is at war and possibly that the safety and integrity of the Empire are threatened as they have not been threatened before. But there are still great numbers who do not realize that the framework of civilization is being attacked; and that, should the brute force of the aggressor triumph, mankind will be plunged back into a darkness worse than that of the Middle Ages. This will be like darkness that can be felt, because man will remember that he once had a glimmering of the light into which he might eventually have passed. The civilization at stake is not a question of personal comfort, of modern conveniences, of speed, of labour-saving gadgets, of easy luxury; it is something much harder to define. The civilization that we fear to lose is something intangible, something built up by man's intelligence, founded on understanding and fashioned on a sense of values. This civilization has respect for human life and for man as an individual; it sees the individual as the master of his fate, the captain of his soul, able to judge the noble and the base, and free to choose his own course. Admittedly we have not advanced very far along this road; but our opponents will have none of it and would take from us what we have. This is what every member of the community must realize, and those who know it must make the position clear to those who are unaware.

To know what is happening and to be a watcher is useless. Some of those who know what is happening, and who watch, are worse than useless, and even dangerous. Among these must be numbered those persons who, calling themselves pacifists, are content to allow others to fight for them and to enjoy the protection secured for them by ultimate victory. Many of these people are painfully sincere, or appear so to be, and they talk and act as though in the present conflict hegemonic aspirations alone were the issue. They say in effect: "If the enemy does take all light from our lives and deprive us of the attributes of free men and women, we shall not resist." The only possible answer to these people is that he who is not for us is against us. We must all do something; we must help to "make things happen". To be resolute, in other words unshrinking or firm of purpose, as we have recently been urged by our statesmen, is not sufficient. We cannot all be prime ministers; if we could, Australia would be in worse case than the country ruled by the king "in the wonder-working days of old" who "promoted everybody".

The Prime Minister is, as his title tells us, the first servant of the State; and we can all be ministers, servants, of the State—we can all help to "make things happen". Medical practitioners have special qualification for service, and the great majority, if not all, of them are anxious to do something. Some, perhaps naturally enough, want to do something big, something that will have a telling and lasting effect on the struggle. Many complain that they do not know what to do, that no one has power to command this or that service. Others, maybe, are resentful of the undue burdens carried by certain of their number, while those whom they regard as "slackers" appear to make no alteration in their activity or in their mode of living. It must be remembered that, though many medical practitioners hold that the services of the profession should be conscripted, this is not likely to be done unless the whole resources of the community are conscripted. In any voluntary system there will always be inequality of sacrifice. To the enthusiast, the true patriot, the real worker for humanity, this will not matter much, though it may at times be galling. By far the greater number of medical practitioners in the Commonwealth have signified their willingness to serve the country. Many have offered for service abroad, and the services of some have for one reason or another not been accepted. What is clear is that every medical practitioner must do the work that lies nearest, while he waits for greater opportunities. For example, a practitioner in a "one-man" town or district is not likely to have his offer for service abroad accepted if he cannot be replaced in his town or district. Such a man is serving his country by remaining where he is just as surely as the man who goes overseas. There are many ways in which medical practitioners who cannot go abroad may give, and are giving, assistance—in the examination of recruits, in the giving of certain lectures, in agreeing to act as area officers in the event of air raids, in trying to give faithful service to the patients of their fellows serving overseas, and in many other ways. Medical practitioners, of course, like other members of the community, can carry out the suggestions made from time to time by the authorities in such matters as the saving of petrol, judicious spending, the buying of war savings certificates, and so on. If people cannot be trusted to carry out small duties that lie near at hand, they will be untrustworthy in matters of greater moment. "He that is faithful in that which is least is faithful also in much."

One point remains. The present is not the time to sing: "God Who made thee mighty, make thee mightier yet." Might for might's sake is unworthy of us. If we keep before our eyes the values of true civilization and fight to uphold them, democracy, true democracy, will be safe, and the British Empire, conscious of its failures and deficiencies, as we hope and pray it may become, will not only be safe, but will be able to fulfil its destiny in the liberation of mankind.

## Current Comment.

### SURGICAL OBLITERATION OF PATENT DUCTUS ARTERIOSUS.

ROBERT E. GROSS has explored the possibility of surgical cure of patent *ductus arteriosus*, and in a series of recent publications he and his colleagues have described successful obliteration in four cases.[1]

The diagnosis of this abnormality depends on the presence of: (i) a loud rough "mill-wheel" murmur, heard best in the third left intercostal space and continuous throughout the cardiac cycle, rising in intensity during systole and falling in diastole; (ii) a corresponding precordial thrill; (iii) a low diastolic and fairly normal systolic blood pressure, producing a pulse of the Corrigan type; (iv) an accentuated cardiac action; and (v) evidence in a radiograph of dilatation of the pulmonary artery and vascular congestion of the lung fields. That this is a grave form of heart disease is shown by the fact that the average duration of life of patients affected is approximately twenty-four years. The common causes of death are bacterial endocarditis or endarteritis, cardiac failure, arterial rupture, and thrombosis in the ductus followed by embolism.

Having devised a suitable operative technique on the cadaver, and after trial on living dogs, Gross operated with success on four patients. All had characteristic physical findings, and all had some degree of impairment of general health as a result

[1] *The Journal of the American Medical Association*, February 25, 1939; *Surgery*, August, 1939; *American Journal of Diseases of Children*, March, 1940; *Annals of Surgery*, September, 1939.

of the cardiac lesion. Operation and convalescence were uneventful in the case of two girls of seven years. In the operation on a boy of eleven years the ductus was torn during dissection, but the alarming hæmorrhage was controlled, and thereafter operation and convalescence were uneventful. In a girl, aged seventeen years, a pleural effusion developed after operation, but resolved spontaneously, leaving the patient well.

The heart is approached by cutting through the second and third left costal cartilages and retracting the ribs. The pleural space is opened and the collapsed lung is packed away to the left and behind. The pleural covering of the mediastinum is incised to expose the pulmonary artery and the arch of the aorta. The ductus is slowly and carefully dissected clear and ligated with heavy silk. A trial ligature is first left on for a few minutes to make certain that no cardiac embarrassment ensues. The wound is closed and the lung reexpanded by positive pressure anæsthesia.

Gross is careful to point out that operation is not indicated if the abnormality is not interfering with the patient's health in any way. Moreover, the abnormality is associated with other cardiac deformities in two cases out of three, and it would be a disastrous procedure to ligate a ductus that was functionally compensating for stenosis of the aortic or pulmonary valves, or a coarctation of the arch of the aorta. When those patients are excluded who suffer no great disability or whose deformity is a complex one, there remains a group of patients who would seem likely to receive permanent benefit from this operation. Gross is to be commended on a skilful and courageous piece of work, tempered by wisdom.

## ANTIHORMONES.

WHEN Bayliss and Starling discovered secretin and made it representative of a class of substances to which they gave the name hormones, they suggested, guided by immunity theory, that the chemical messengers must be of low molecular weight and incapable of arousing the tissues to form antibodies. Within a week of the discovery of secretin this substance was found to withstand a temperature of 110° C. in a sealed tube without forfeiting any of its power to stimulate the pancreas. This conception of the non-antigenic properties of hormones was not generally accepted and possibly not generally comprehended, for in 1906 Möbius announced an antithyreoidin which was put on the market by Merck, for the relief of Graves's disease, with all the imposing clinical records which German firms knew so well how to prepare. Subsequent experience showed that whatever improvement took place was psychic. Somewhat later horses were injected with posterior pituitary extract and the serum thus obtained was stated to remove or to reduce the glycosuria of diabetes and to relieve hypertension; but once more the hopes raised by commercialized propaganda were wrecked by consistent negative results. Starting from 1924 a series of investigations was conducted to detect the existence of an anti-insulin. It was found with certain insulin preparations that large doses were less effective than small doses, though if massive injection was employed, a return of potency took place. This phenomenon was attributed to the formation of anti-insulin. Once again the possibility of an antithyreoid hormone being elaborated was investigated, and quite recently a preparation was put on the market for the treatment of Graves's disease; but experiments showed that normal blood behaved in much the same way as that of the injected animal. More convincing were the investigations on gonadotrophic and thyreotrophic hormones arising from the anterior pituitary. Here the phenomenon was described and the conclusion confirmed that repeated injections led to a diminished effect. That this is not due to exhaustion of the organ activated was proved by administering, after loss of response, small doses of the pituitary agent from another animal when full activity was displayed. Collip and his pupils, starting in 1934, proclaimed definitely the hypothesis that gonadotrophic and thyreotrophic hormones of the pituitary excited the formation of antihormones. The latest pronouncement of Collip and his collaborators[1] indicates that the blood of animals treated with gonadotrophic and thyreotrophic pituitary hormones acquires the property of neutralizing such hormones, from whatever animal they are derived. Furthermore, there is this specificity, that the alleged antigonadotrophic has no inhibitory action on the thyreotrophic or even on other forms of gonadotrophic agents. The presence of the organ normally activated is not necessary for the development of the inhibitory factors. The authors are careful to state, however, that "there is little or no evidence that chemically pure hormone preparations such as the œstrogens, adrenaline, etc., may form antihormones in the true sense of the word".

When Bayliss and Starling inaugurated the study of the hormone regulation of organs, they did not investigate the fate of each hormone when it had acted on its special effector organ. Obviously secretin could not go on circulating in the blood and stimulating the pancreas indefinitely; it must be "used up" or put out of action once it has achieved its immediate task. We owe to Sir Henry Dale and his school our knowledge of the enzymic destruction of acetylcholine by an esterase. Adrenaline in any circumstances has a short life, as it is highly susceptible to oxidation. But the mechanism for arresting the continued activity of other hormones, and especially those of the anterior pituitary, remains undisclosed. It is probable that these investigations of Collip and his school will throw light on this fascinating problem.

[1] *Biological Reviews of the Cambridge Philosophical Society*, January, 1940.

# Abstracts from Current Medical Literature.

## PHYSIOLOGY.

### The Metabolism of Rabbit Bone Marrow in Serum.

CHARLES O. WARREN (*The American Journal of Physiology*, February, 1940) presents a comparison between the metabolism of slices of rabbit bone marrow suspended in serum and in Ringer solutions. Orr and Stickland in 1938 studied the metabolism of suspensions of rabbit bone marrow in Ringer solution and concluded that the marrow has a type of metabolism similar to "that of tumour tissue, retina and kidney medulla". The author states, however, that a "tumour" type of metabolism is not found when the measurements are made in serum. The metabolism of normal rabbit bone marrow in serum is essentially comparable with that of other adult normal tissues, in particular lymphocytic tissue. The use and advantages of "neutralized" serum in bone marrow respiration studies are described. The mechanism of the serum effects is under investigation.

### Sympathetic Action in Accommodation for Far Vision.

M. W. MORGAN, JUNIOR, J. M. D. OLMSTED AND W. G. WATROUS (*The American Journal of Physiology*, February, 1940) state that it has been shown that a sudden exciting stimulus causes a brief change in the refraction of the rabbit's eye (in the direction of increased hypermetropia) and in the human eye as well. It has been suggested that this reaction is the result of sympathetic stimulation. These authors describe experiments showing that the sympathetic may indeed play a major role in the processes involved in accommodation for far vision and a minor role in that for near vision. They have found that stimulation of the sympathetic nerve or superior cervical sympathetic ganglion in the rabbit, cat and dog gives marked increase in hypermetropia (flattening of the lens), whether the eye is under atropine, whether the third nerve is intact or cut, or whether pressure effects on the eyeball are eliminated by cutting the majority of the extrinsic muscles. They state that accommodation of the eye for near and far vision presumably involves reciprocal action of the sympathetic and third nerves.

### Diet and the Gonadotropic Hormone.

IN recent years gonadotropic extracts have been prepared from several foodstuffs, but no one has shown that these gonadotropic materials are of physiological significance. The chemical nature of the active fractions of the pituitary hormones suggests that they might be derived, ultimately, from dietary protein. In the rat, restriction of dietary protein, quantitatively or qualitatively, leads to an abrupt cessation of the vaginal œstrous cycle and of ovulation; but it has not been shown conclusively that the condition is actually due to pituitary hypofunction. Maurice H. and Gertrude S. Friedman (*The American Journal of Physiology*, February, 1940) observe that if it were possible to produce a true pituitary hypofunction by dietary deficiency, it might then be possible to determine the significance of the foodstuffs which yield gonadotropic extracts. Failing this, they have made use of the rapid changes in the rabbit pituitary. It has been found that in this animal the gonadotropic hormone of rabbit pituitary is almost completely discharged by the act of coitus, and that for the first four to six days of pseudopregnancy the hormone content of the gland does not increase significantly. The authors have shown that the process of gonadotropic hormone restitution, as measured by their methods, was not influenced by protein restriction at least as severe as that which produces dietary anœstrous in the rat. Even when a protein-free diet was given, the excess of hormone stored during the first eight days of pseudopregnancy, over and above the amount released to the peripheral tissues, was fully equal to the excess stored by the control animals in the same period of time. Despite the adverse dietary conditions, those factors responsible for the seasonal changes in the pituitary were able to exert their full influence. Consequently the authors are obliged to conclude that the rabbit pituitary is more responsive to seasonal influences than to changes in dietary protein. It appears that the protein requirements for the formation of the gonadotropic hormone can be fully met by the nitrogenous products derived from the rabbit's own tissues, even during the stress of serious nitrogen deficit.

### The Pressor Effects of Heated Kidney Extracts.

E. M. LANDIS, W. A. JEFFERS AND E. H. SHIELS (*The American Journal of Physiology*, March, 1940) point out that it has been shown repeatedly that certain extracts of normal kidney tissue contain an apparently unique pressor substance, which has been called renin. They add that, although kidney extracts from various animals are said to differ with regard to their content of renin, no systematic study of specific variation has been made. The content of renin has been determined in many instances by heterologous injections. Since it has been stated that the results obtained by heterologous injections are undependable, and since heterologous extracts must be used in assays of human kidney extracts, the authors have reinvestigated the whole subject. They summarize their article by stating that rapidly repeated injections of rabbit kidney extracts into intact animals, with or without anæsthesia, lead to a diminishing response (tachyphylaxis). Rabbits receiving rabbit kidney extracts at intervals ranging from twenty-four hours to seven or ten days exhibit no significant change of resting blood pressure or conspicuous change of sensitivity to renin. When rabbits have received an injection of similarly prepared extract from another species, subsequent injection of that extract after a suitable interval produces respiratory distress, a sharp drop in blood pressure, blanching of the ear, arteriolar constriction in the ear, and death if the injection is not stopped immediately. The general picture is that of anaphylactic shock. In the performance of assays of kidney extracts it seems advisable to use single injections in order to avoid both tachyphylaxis and anaphylaxis. Potent kidney extracts raise blood pressure in the species of origin and in other species as well. Extracts of normal rabbits' kidneys are most actively pressor, those from rats and guinea-pigs somewhat less active, and those from man and dog least active when prepared by being heated to 55° C. for twenty minutes. The reactivity of these species varies, however, in that with a given group of extracts the rat and guinea-pig show more conspicuous elevation of blood pressure than do the dog and rabbit after injection of equivalent doses.

### The Action of the Sphincter of Oddi.

G. S. BERGH AND J. A. LAYNE (*The American Journal of Physiology*, March, 1940) have carried out experiments on five patients who had undergone cholecystectomy, choledochotomy and intubation of the common bile duct. By means of a rubber tube and manometer connected to the cholecystectomy tube and a flow-recording device, and by a duodenal tube and tambour attached to a balloon in the duodenum, tracings were made. The observations are described and the general conclusion is stated that the sphincter of Oddi can act independently of the duodenal musculature.

### Effect of Cortin After Hepatectomy.

H. SELYE AND C. DOSNE (*The American Journal of Physiology*, March, 1940) report experiments indicating that the decrease in blood volume, blood chlorides and blood sugar caused by removal of 85% of the liver from fasted rats is inhibited by administration of adrenal cortical extract. The experiments support the view that this hormone has a stabilizing effect on the blood sugar. After complete hepatectomy the decrease in blood sugar is not significantly influenced even by large doses of cortin. It is therefore probable that the cortical hormone does not inhibit the utilization of circulating sugar; it probably stimulates gluconeogenesis in the liver.

## BIOLOGICAL CHEMISTRY.

### Blood Plasma Protein Production.

S. C. MADDEN, C. A. FINCH, W. G. SWALBACH AND G. H. WHIPPLE (*The Journal of Experimental Medicine*, March, 1940) report further studies on the production of plasma protein by dogs maintained on basal rations and rendered hypoproteinæmic by plasmaphoresis. Casein and liver protein tested as basal proteins gave yields of plasma protein up to 33% of that fed. This value approached the utilization of plasma protein by mouth (40%). Zein as a supplement to the basal diet had no effect on plasma protein production, but when supplemented with cystine, tryptophane, lysine and glycine doubled the basal production. Liver protein supplemented with cystine, leucine, glutamic acid and glycine yielded double the amount of newly formed plasma protein compared with liver alone. Homologous plasma protein given by vein promptly corrected experimental hypoproteinæmia induced by bleeding. It maintained nitrogen equilibrium and replenished protein stores. Even during hypoproteinæmia, plasma protein promptly passed out of the circulation to supply body needs for protein.

### Calcium-Phosphorus Ratio and Iron Assimilation.

H. D. ANDERSON, K. B. MCDONOUGH AND C. A. ELVEHJEM (*The Journal of Laboratory and Clinical Medicine*, February, 1940) have studied the relation of the dietary calcium-phosphorus ratio to the utilization of iron. Rats were made anæmic on a milk diet and then transferred to dry rations, of varying calcium-phosphorus ratios, which gave growth rates and hæmoglobin regeneration comparable with that of mineralized milk. A low calcium-phosphorus ratio was found to be favourable to iron utilization, since maximum utilization occurred at Ca/P = 0·45, with decreasing utilization as the Ca/P figure increased to 7·65. The results indicated that within limits ordinarily reached in most diets, calcium impeded the absorption of iron, while phosphorus had a stimulating effect.

### Micro-Prothrombin Test.

KATSUJI KATO (*American Journal of Clinical Pathology*, February, 1940) has described a modification of the method of Quick, Stanley-Brown and Bancroft for the estimation of prothrombin in blood. The modified test requires only small quantities of blood (10 cubic millimetres for each test) and can therefore be repeated frequently, even on young infants. Blood is collected, by puncture, on an oxalated well slide, added by micropipette to a mixture of calcium chloride solution and suspension of thromboplastin, and the clotting time is observed. The prothrombin content is thus measured in terms of coagulation time upon recalcification in the presence of excess thromboplastin. The test is considered simple enough to be included in routine hæmatological work.

### Wernicke's Disease and Vitamin $B_1$.

LEO ALEXANDER (*The American Journal of Pathology*, January, 1940) reports a detailed histological study of the lesions in Wernicke's hæmorrhagic polioencephalitis of man and in vitamin $B_1$ deficiency of pigeons. Observations were made in sixteen cases of Wernicke's disease—twelve were due to chronic alcoholism, two were associated with scurvy, one with pernicious anæmia and one with depressive psychosis in a cachectic individual. The disease in pigeons was produced by feeding diets deficient in vitamin $B_1$ only, but containing high doses of other vitamins. The lesions observed in man and pigeons were identical in their topographical distribution and in their morphological and histological characteristics. The article is illustrated by many photomicrographs.

### Phosphatase Activity of Infected Fractures.

D. H. DRUMMOND, J. P. TOLLMAN, J. DEWEY BISGARD AND D. ROSS (*Archives of Surgery*, January, 1940) have studied the levels of phosphatase and of calcium in infected fractures in rabbits. They found that the levels were lower than in sterile fractures. There was, however, a uniform rise in the level of blood phosphatase in the infected series. As in sterile fractures, high levels of local phosphatase activity were associated with the presence of large calcium deposits.

### Tissue Metabolism and Phosphatase Activity in Early Callus.

J. P. TOLLMAN, D. H. DRUMMOND, A. R. MCINTYRE AND J. DEWEY BISGARD (*Archives of Surgery*, January, 1940) have studied the relation of blood phosphatase, tissue phosphatase, tissue calcium and tissue metabolism in a series of rabbits subjected to osteotomy. There was an initial rise in tissue metabolism of the callus, followed by a fall. There was an irregular increase in phosphatase activity and calcium deposition with time. The changes in concentration of serum phosphatase were not characteristic, as there was no definite relation between the level of the blood phosphatase and the healing of the fracture. A close relation was found between the phosphatase activity of the callus and the amount of calcium deposition.

### Prothrombin and Vitamin K in Liver Disease.

F. J. POHLE AND J. K. STEWART (*Journal of Clinical Investigation*, March, 1940) have studied the use of vitamin *K* in the treatment of the bleeding tendency in obstructive jaundice. In a series of 136 patients with liver and biliary tract disease the plasma prothrombin was below normal in 47%. Intrinsic liver disease was a frequent cause of the prothrombin deficiency. In each of ten individuals, who exhibited abnormal bleeding, there was a considerable reduction of plasma prothrombin. The data suggested that hæmorrhage should be anticipated when the prothrombin concentration fell to 30% or less. The effect of the administration of vitamin *K* and bile salts on the prothrombin of 46 jaundiced patients who had a reduction in coagulation factor was not uniform. Twenty-eight patients showed a satisfactory increase in prothrombin, while 18 showed no increase. The failure in many of these 18 patients was due to extensive hepatic damage, as shown by liver function tests or histopathological examination or both. Similar studies showed no indication that hepatic damage of similar degree was present in the group of 28 patients who responded satisfactorily. The decrease in prothrombin, which was not uncommon after surgical intervention in jaundiced patients, was especially apt to occur if hepatic damage was present. The studies suggested that in the absence of obstructive jaundice, external biliary fistula or an abnormal intestinal surface, the plasma prothrombin concentration serves as a measure of liver function.

### Sulphur Metabolism in Arthritis.

R. H. FREYBERG, W. D. BLOCK AND M. F. FROMER (*Journal of Clinical Investigation*, March, 1940) have conducted sulphur metabolism studies on normal adults and arthritic patients. No attempt was made to evaluate sulphur therapy on the basis of clinical changes in the patients. There was no important difference in the amount of sulphur eliminated by arthritic patients as compared with normal persons. The amount of sulphur eliminated in each urinary fraction was practically identical in arthritics and controls, except for slightly higher conjugated fractions in the arthritics; if significant, this difference indicated that a sufficient supply of sulphur was available for conjugation and that there was no impairment of the detoxication mechanism. Injection of colloidal sulphur, either intravenously or intramuscularly, effected the same changes in arthritic and normal persons. The injected sulphur was eliminated chiefly as inorganic sulphate. No difference was observed between arthritic and normal persons in the reactions to oral administration of sulphur as sodium thiosulphate or in colloidal form. Oral administration of thymol showed that there was no impairment of the detoxication mechanism. The authors conclude that there is no evidence of sulphur deficiency or abnormality of sulphur metabolism in patients with arthritis, and that the data reveal no biochemical or metabolic indication of the need for, or benefit from, sulphur medication in the treatment of arthritis.

# Medical Societies.

## MELBOURNE PÆDIATRIC SOCIETY.

A MEETING of the Melbourne Pædiatric Society was held at the Children's Hospital, Carlton, Melbourne, on April 10, 1940, DR. H. DOUGLAS STEPHENS, the President, in the chair. The meeting took the form of a series of clinical demonstrations by the members of the society.

### Exophthalmic Goitre.

DR. J. W. GRIEVE showed a girl, aged eight years, suffering from exophthalmic goitre, who had rapidly and recently developed acute symptoms. A cousin of the child's father was the only other member of the family with goitre. She had lived in the country, but not in an area in which goitre was common. At the age of seven years she had been so well grown that her mother had been concerned about her excessive weight. At that time she had had measles, and her tonsils were removed; it was also noticed that the thyreoid gland was slightly enlarged. At the end of 1939 a doctor had observed that there was considerable thyreoid enlargement and had advised the use of Lugol's solution of iodine, of which she had five minims twice daily for two months. A rapid and dramatic change had taken place in the condition of the patient during the past two months; her weight had decreased from 89 pounds to 62 pounds; her eyes had become prominent, and she was nervy, irritable, bad-tempered, emotional, timid and restless. The goitre had increased rapidly in size; her appetite was enormous; she had had occasional mid-abdominal pain and mild diarrhœa at times; and her feet and hands sweated a lot.

On examination it was found that the eyelids lagged and she was unable to wrinkle her forehead; the heart was enlarged, and a systolic murmur was audible over its base; she was dyspnœic on exertion, but there was no obvious tremor or other neurological sign of an abnormal nature. The thyreoid enlargement produced a uniform, regular and smooth swelling in the neck.

Dr. Grieve said that the patient was having a full diet and the intake of fluid was not restricted. Sedative treatment consisted of the regular use three times a day of phenobarbital, three-quarters of a grain, and at night she received a mixture of chloral and bromide, if necessary, to induce sleep.

DR. RUSSELL HOWARD said that the age factor was of interest. If the patient was older they would regard the condition as just a usual example of toxic goitre. He commented that the opinion had been expressed frequently that it could be dangerous to give Lugol's iodine solution, and it might have proved harmful in the present case. The associated choreiform movements might not be rheumatic, but might be due to thyreotoxicosis. So far as treatment was concerned, most surgeons would advise the removal of thyreoid tissue if the patient was older, and in his opinion bilateral subtotal thyreoidectomy was indicated.

DR. W. R. FORSTER asked Dr. Grieve to give an account of the further history of the two children shown at a previous meeting of the society, because on that occasion the consensus of opinion was against operative interference.

DR. W. McL. SMITHERS said that he thought the normal course was to let the thyreotoxicosis burn itself out. If thyreoid tissue was removed under the age of sixteen years, it was likely that the other endocrine glands would be adversely affected. He suggested that the operation should be postponed and that the patient should be kept under sedative treatment and at rest in bed.

Dr. Grieve, in reply, said that he felt that the situation in the present instance was rather different from that of the previous occasion to which Dr. Forster had referred. The symptoms had arisen acutely and the patient had gone down hill rapidly during the past two months. He had formed the impression that she would have to be submitted to surgical intervention after further observation in hospital. With reference to the fate of the other patients, Dr. Grieve was able to state that one of the cases was of particular interest. The girl, aged thirteen years, had had chorea for three months early in 1929 and had become thyreotoxic in September, 1930. Her progress had been extremely satisfactory, although no operation had been performed, and her health was good; she still had, however, a mitral systolic bruit, and that evidence of mitral disease modified the prognosis. Dr. Grieve added that in most instances of toxic goitre choreiform movements, if present, were evidence of dysthyreoidism rather than of rheumatic infection. He had noticed that on careful examination choreiform movements could be detected frequently and that tremor was relatively uncommon. It was very hard to estimate the basal metabolic rate of children, and the results were usually unreliable.

### Prematurity.

DR. W. McL. SMITHERS showed a premature baby with the object of demonstrating that, under suitable conditions, though the food value and the volume of fluid taken might be far below the alleged requirements, the baby might thrive abundantly after the manner of a normal baby. The infant was born at a private hospital at least six weeks prematurely and weighed only two pounds twelve ounces at birth; the labour was spontaneous and the pregnancy was uncomplicated. In order to utilize to the greatest advantage the breast milk of the mother and to lessen the risks of respiratory infection, it was decided to keep the baby in the hospital nursery and to provide special nurses night and day. From the outset the baby was fed every two hours. At first he would take only one drachm at a time; but the amount per feeding was gradually increased to three drachms by the eighth day. Then possetting commenced, accompanied by cyanosis and weakness of the pulse, with loss of appetite and deep jaundice. For four days while he was so ill the baby took one or two drachms every hour by day and every two hours by night either of breast milk or of a weak saline solution containing 5% of lactose, according to the ease of administration. As his condition improved he took more at a time; milk was given instead of saline solution, and soon the two-hourly régime was restored. At the age of fifteen days he sucked the feeding from the pipette and soon from a bottle. Then larger feedings were given, until at six weeks he took one ounce every two hours. The interval was then increased to three hours, and later the night feeding was omitted as the amount taken per feeding increased; no further difficulty had been encountered, even though artificial feeding with a cow's milk mixture had been substituted at the age of two and a half months. At the time of the meeting the baby was aged six months, weighed fifteen pounds and looked remarkably well and strong.

Dr. Smithers said that the interest of the case lay in the fact that the weight chart showed that the baby had made uninterrupted progress from birth, although the average number of Calories taken per pound of body weight per day for each of the first six weeks was 27, 18, 26, 20, 30 and 40 respectively; and the corresponding average number of ounces of fluid per pound taken per day was 1·1, 0·9, 1·3, 1·1, 1·6 and 20 respectively. At six weeks of age the baby weighed four pounds two ounces. In conclusion, Dr. Smithers directed attention to the outstanding importance of skilled and conscientious nursing, and paid a tribute to the nursing staff of the private hospital concerned in obtaining the splendid result in the present instance.

DR. H. BOYD GRAHAM congratulated Dr. Smithers on the excellent result that had been obtained and said that he realized what a lot of careful work Dr. Smithers had done to secure the success achieved. There was no question from the appearance of the baby that he was unusually virile for a premature infant; the strength and virility of such a baby in the early weeks of life was an important factor in prognosis. Dr. Graham hoped, however, that Dr. Smithers would not be misunderstood by those who were apt to generalize from the particular; it took more than one swallow to make a summer. A

higher energy value of the food and more fluid remained the rule for premature babies, and the one shown by Dr. Smithers was an example of an exception to that rule.

DR. J. H. COLEBATCH observed that the baby was less immature than usual, and as the mother and father were both small, the baby at the age of two months might not have been so very much under the expected weight. He then referred to Moncrieff's work on thyreoid medication for premature babies, based on the acceleration of the metamorphosis of tadpoles. It was not held that thyreoid treatment aided gain in weight.

Dr. Smithers, in reply, agreed that the baby was very virile; but there was no question that he was born six weeks before the due date and was very small at birth. He had formed the opinion that it was physically impossible for tiny babies to hold the amount considered to be necessary in the first few weeks of life. He was very keen on breast-milk feeding and did not like to "bolster up" the energy value with artificial food. He was quite prepared to admit that nine out of ten premature babies would not have done so well as the one he had shown that night.

### Pathological Exhibit.

DR. REGINALD WEBSTER showed a collection of pathological specimens illustrative of malformations and dilatations in the urinary tract. He said that he would not discuss them, in view of the fact that he had traversed this subject at the meeting of the society reported in THE MEDICAL JOURNAL OF AUSTRALIA of August 12, 1939. Dr. Webster had also placed on view two specimens which, in their excellent colour preparation and mounting by Mr. H. Weir, he believed could scarcely be improved upon as illustrative of the cardiac lesions in subacute bacterial endocarditis. Both specimens had been secured at recent autopsies by Dr. Howard Williams, to whom for many months past Dr. Webster had been greatly indebted for assistance in the discharge of the routine post-mortem work of the hospital.

In a brief discussion of subacute bacterial endocarditis Dr. Webster said that it appeared that the dictum that the disease was invariably fatal had now to be modified. Recoveries had been reported by such authoritative contributors to the literature of the subject as Horder and Thayer; but it remained true that if the diagnostic triad of cardiac murmur, embolic phenomena and positive finding by blood culture were insisted upon, the number which could be accepted as recoveries was exceedingly small.

The importance of antecedent valvular disease in the pathogenesis of subacute bacterial endocarditis was questioned by none. It could be confidently stated that valvular damage was the underlying factor in 80% of cases of the disease and that in 65% the valvulitis was of rheumatic origin. Valvular predisposition was also occasioned by congenital malformation, and in this connexion a congenitally bicuspid condition of the aortic valve was conspicuous. Attention had been called by Lewis and Grant to the association of this particular type of congenital cardiac malformation with subacute bacterial endocarditis; they had demonstrated congenitally bicuspid aortic valves in 26% of 31 cases of subacute bacterial endocarditis. If Dr. Webster remembered aright, Boyd had made the statement that of males possessing bicuspid aortic valves who reached adult life, 23% died of active endocarditis.

Dr. Webster went on to say that one of the children from whom the specimens he exhibited had been obtained, provided exceptional bacteriological findings. It was scarcely necessary for him to remind the meeting that subacute bacterial endocarditis was almost invariably initiated and sustained by the *Streptococcus viridans*, which organism should be recoverable by blood culture. It had to be conceded, however, on high authority, that occasionally the *Hæmophilus influenzæ* assumed the part of the infecting organism in subacute bacterial endocarditis. In the case of the child to whom he had referred, the first blood culture had yielded a diphtheroid bacillus. Little notice was taken of the finding, in view of the ubiquity of diphtheroids and their frequent disposition on the skin. On three occasions the diphtheroid was recovered by blood culture during life; but Dr. Webster had been reluctant to accept it as significant. Scepticism could not be maintained, however, against the post-mortem demonstration of the diphtheroid bacillus, in enormous numbers and to the exclusion of all other bacteria, in a fragment from one of the accretions on the mitral valve. He had been interested to find that a similar experience had been recorded by Foord and Stone in 1934. These workers had reported the recovery by blood culture, *ante mortem*, on four separate occasions of a diphtheroid bacillus in the investigation of a patient in whose case the clinical diagnosis was subacute bacterial endocarditis. The diagnosis was confirmed by autopsy and the diphtheroid bacillus was demonstrated in very large numbers in the friable valvular and mural vegetations.

A remarkable feature of subacute bacterial endocarditis was that, in spite of immunological evidence that the resistance of the body to the *Streptococcus viridans* was greatly stimulated, it seemed impossible to dislodge this organism from the endocardium once it became established. High agglutination titres against the specific microorganism had been frequently demonstrated, and the striking work of H. D. Wright had shown that the blood of patients suffering from subacute bacterial endocarditis was actively bactericidal to the infecting streptococcus. Wright showed by quantitative cultivation from blood withdrawn into sufficient sodium citrate solution to act as anticoagulant, but with no addition of any form of culture medium, that the number of living cocci in the blood of one patient fell from 104 per cubic centimetre prior to incubation to one per cubic centimetre after incubation for twenty-four hours. In another patient the microorganisms were reduced from 111 per cubic centimetre to none by twenty-four hours' incubation of the citrated blood. Wright's work was to be found in *The Journal of Pathology and Bacteriology*, Volume XXVIII, 1925, at page 541.

Dr. Webster remarked that the only explanation to be offered for the phenomenon of an organism of low virulence entrenching itself against a highly developed immunity in the host was that it was for some reason inaccessible. The streptococci seemed to be effectively protected against natural immune bodies and bactericidal drugs introduced therapeutically by the thick layer of fibrin, of which the surface of the vegetation was composed.

The *Streptococcus viridans* was consistently found in the mouth, on or in the tonsils and in the lower bowel. In speculation upon the pathogenesis of subacute bacterial endocarditis the mouth had always been suspect as providing the streptococcus with an entry to the circulation. Arresting in this connexion was the work of Okell and Elliot (*The Lancet*, Volume II, 1935, page 869), who had carried out a series of cultures from the blood of patients undergoing dental extractions. Okell and Elliot had shown that an organism, usually a streptococcus, was recoverable from the blood a few minutes after extraction in 75% of cases in which dental extraction was performed in the presence of badly infected gums. In approximately 10% of such cases positive findings attended the blood culture even before the extraction. The proportion of positive results after extraction varied with the degree of oral sepsis; but even after extraction from an apparently healthy mouth a transient bacteriæmia supervened in 34% of instances. In conclusion, Dr. Webster said that it could reasonably be deduced from the work of Okell and Elliot that bacteriæmia was a frequent concomitant of oral sepsis, apart from any interference. The trauma of dental extraction commonly resulted in a heavy infection of the blood stream from a septic mouth; and occasionally some degree of systemic infection followed extraction of teeth from a presumed healthy mouth. The suspicion that had for long been directed against the mouth as the atrium of infection in subacute bacterial endocarditis was therefore well founded.

### Congenital Malformations of the Urinary Tract.

DR. E. E. PRICE showed two patients, a boy with hydronephrosis and one with congenital stricture of the ureter. The first boy, who was aged almost fourteen years, had

come under his care on September 26, 1939, for investigation of a renal disorder. For four months the boy had had dull pain across the loins and in the right flank, which was severe at times and was present more or less constantly; it had interfered seriously with his school work, at which he was unusually proficient. The patient stated that he had had slight pain for a longer, though indefinite, period. There had been feverish attacks when the pain was worse, associated with scalding of micturition; but lately there had also been a slight increase in the frequency of micturition. At the early examination it was found that he was somewhat tender in each loin and that the urine contained bacilli. Pain in the right side had persisted; but on the administration of alkalis the bacilli soon disappeared from the urine. In plain skiagrams there was no indication of the presence of an abnormality of the genito-urinary tract; but from the films taken after the use of "Uroselectan" it was considered that each of the kidneys had concentrated the substance well and that on the right side a state of hydronephrosis and hydroureter was present. Dr. Price said that on two occasions cystoscopic examinations had been performed; the right ureteric orifice was seen to be larger than the left one. He had been unable to confirm the presence of hydronephrosis or hydroureter by retrograde pyelographic examination, though the renal calyces were more clubbed on the right side. While he was under investigation in the out-patient department over a period of three months, the boy had continued to have pain and tenderness across the back and in the right flank, and he had become very miserable.

On December 27, 1939, an exploratory operation was performed on the right kidney. The kidney was normal in appearance and the ureter and pelvis did not appear to be large. A large aberrant vein was defined running from the upper pole towards the diaphragm; it had to be divided before the kidney could be delivered, and after division of the vein the upper pole became blue immediately and permanently. The renal pedicle was identified and the periarterial structures were stripped from a section of the renal artery about two centimetres in length. Then the wound was closed. Dr. Price said that the boy had made an uneventful recovery; he had been completely freed from pain and had gained a stone in weight. No pus cells or red blood cells had appeared in the urine. It had been interesting to note that in the excretion pyelograms obtained three months after the operation there were no appearances indicative of deformation or scarring of the upper pole of the kidney.

The other patient shown by Dr. Price was a boy, aged two years and six months, whom he had first seen in the out-patient department on August 23, 1939. For three months the boy had had attacks of abdominal colic passing through to the back; during these attacks he had formed the habit of holding the penis. For the same period he had had frequency of micturition and dribbling of urine, and it was said that he had at times passed a little bright blood.

On examination the urinary meatus was seen to be excoriated; bacilli, but no cells, were present in the urine. It was considered, after an excretion pyelographic examination made on August 29, that the pelvis was not enlarged; but the right ureter was moderately dilated, the dilatation terminating conically at the level of the iliac crest. For a while the child's general condition was satisfactory, but as he had had three or four attacks of abdominal pain, he was admitted to hospital on January 26, 1940, for further investigation and treatment. By cystoscopic examination it was found that the bladder appeared normal, though hydroureter was present; the catheter was passed quite easily, the presence of a calculus being thus excluded.

On February 2 an operation was carried out in which the right kidney and ureter were exposed. The upper part of the ureter was dilated and ended near the iliac crest in a smooth stricture. The ureter was opened above the stricture to allow of the passage of a small probe, the head of which was gripped by the stricture. The stricture was dilated by Hegar's dilators from above downwards to about the size of a number 7 gum-elastic catheter. Dr. Price then decided to attempt Fenger's plastic operation; he divided the stricture longitudinally and sutured it transversely. The resultant distortion increased the obstruction, so he took the sutures out, leaving two holes in the ureter. Rubber tubing of small calibre was passed through the upper hole down through the stricture to the bladder and upwards towards the kidney. The wound was then carefully closed around the free ends of the tubes, the lower of which was sutured in position. Four days later the upper tube came out, establishing a urinary fistula which persisted for thirteen days. Twelve days after the operation the lower tube came out. Dr. Price said that since the operation there had been no return of symptoms; but as the period of observation was only two months it was too soon for him to conclude that the child was cured. The appearances in recent pyelograms failed to indicate any definite change in the condition of the ureter.

DR. D. O. BROWN showed a boy, aged almost five years, with congenital diverticula of the bladder associated with right-sided hydroureter and hydronephrosis. The child had had difficulty with micturition, culminating in complete retention of urine.

On examination it was found that the bladder was distended and cystic swellings were palpable *per rectum* behind the bladder. The presence of a congenital cardiac anomaly was also noted. The blood urea content was estimated at 36 milligrammes per 100 cubic centimetres, and the urea concentration was 1·8% at the third hour. On cystoscopic examination the openings of two diverticula were found, each in close association with a ureteric orifice. From pyelograms it was seen that there was great dilatation of the ureter and pelvis on the right side, though the left side was unaffected. Dr. Brown commented that it had been found possible to cause the right ureter and pelvis to fill by posturing the child during the cystographic examination. He expressed the view that the diverticula of the bladder were congenital in origin and that the hydronephrosis and hydroureter were due to the effect of the close relationship of a diverticulum and a ureter which were in all probability adherent to one another.

Dr. Brown went on to say that comprehensive reviews of cases had been made by Deurieux (1901), Hinman (1919), and more recently by Hyman (1923). Hyman could find only three case reports of the condition in children under ten years, though it seemed probable that with the routine use of cystoscopy more cases would be found. The condition had never been demonstrated in a female child. Dr. Brown quoted E. M. Watson (1920), who, in writing of the developmental basis for bladder diverticula, had said that certain factors were present in the early days of bladder development which might be of importance in determining the formation of diverticula, but their clinical recognition during adult life was hastened and their dimensions were greatly increased by any of the factors that would bring about increased vesical distension or increased activity of the bladder musculature. Dr. Brown said that the onset of symptoms in children was usually sudden and associated with retention of urine, as in the case under discussion. In other cases persistent urinary infection might draw attention to the condition before retention occurred, so that the careful cystographic and cystoscopic examination of the bladder in such cases, if any doubt existed, was most informative.

Dr. Brown said that in the present case the treatment he proposed to carry out was extravesical excision of the diverticula with freeing of the right ureter and its implantation, if necessary, into another part of the bladder. He pointed out that the main bar to successful treatment appeared to lie in the poor renal function, and efforts should be made to improve that by the use of indwelling catheters and by other general measures.

DR. W. R. FORSTER showed a boy, aged three years, who had come under his notice at the time when a lump had been known to be present in the left loin for one month, unaccompanied by any abnormal urinary symptoms. A large cystic mass was found in the left side of the

abdomen, extending up under the ribs and across to the right flank; it felt as though there were a groove down the outer edge of the swelling; the lump varied considerably from time to time in size, tenseness and location. On several occasions a few red blood cells had been found on microscopic examination of specimens of the urine.

On cystoscopic examination dye appeared in the urine from the right side in six minutes; this was not regarded as abnormal. But on the left side cloudy urine presented in occasional spurts and no dye appeared. A catheter passed up the left ureter curled up when it reached the subcostal level and came down again to the lower end of the swelling. At the subsequent operation difficulty was encountered because of the large size of the mass containing foul urine; the peritoneal coat was very thin and stretched out over the kidney; the ureteric opening was fairly high and on the internal side of the tumour. Only a shell of kidney tissue was present, and the pelvis was enormously dilated. Small flattened pyramids projecting into local hydronephrotic sacs seemed to be the cause of the obstruction.

The next patient shown by Dr. Forster was a little girl, aged three years, with "double ureter". For two months she had had frequent attacks of abdominal pain with feverishness, loss of appetite, vomiting, and frequency and scalding of micturition. The urine contained albumin, pus cells and motile bacilli. An excretion pyelographic examination was made, and the appearances in the films suggested the presence of "double ureter". Previously Dr. Forster had made a retrograde pyelographic examination and had not suspected "double ureter"; he had catheterized only one opening and the renal pelvis had been distended. As a result of persistence on Dr. McLaren's part, Dr. Forster had finally found two separate ureteric orifices close together. He had catheterized them and the catheters appeared to cross one another. From one opening dye was secreted within normal time; but no dye had been obtained from the other opening while the patient's bladder was under observation. The lower portion of the pelvis filled separately and became dilated, but the upper portion was not altered in appearance. Dr. Forster said that he showed the patient in order to get an opinion as to whether heminephrectomy was likely to be of benefit or even to be possible without damage to the rest of the kidney.

Dr. Forster's third patient was a girl with double hydronephrosis. She had been admitted to hospital late at night and an operation had been carried out in the belief that she was suffering from acute appendicitis. At the operation an enlarged renal outline was palpated. At the time the urine was clear; but later a few motile bacilli and some pus cells were found in it. The child had had frequent attacks of abdominal pain. On investigation it was discovered that hydronephrosis was present on each side, the dilatation being greater on the right. The patient also had *spina bifida occulta* associated with a patch of hair in the mid-line of the back.

DR. D. O. BROWN, with further reference to the patient he had shown, asked for an opinion as to whether the condition was caused by an organic obstruction or by achalasia due to neuro-muscular dysfunction.

Dr. Forster said that he failed to see how an obstruction could be present when a reflux had been produced by posturing of the child. Some peculiar arrangement must be present, such as abnormal development of a valve.

DR. E. E. PRICE said that he could not make a definite pronouncement about the cause of the dilatation in the case presented by Dr. Brown; but there were three processes by which such a dilatation might occur. The first of these was obstruction of the ureter; a diverticulum might be pressing on the ureter and distorting it. The retention of urine in the present case was against the acceptance of that cause. Another process was an ascending infection, which produced dilatation in a manner comparable with the production of bronchiectasis or sialectasis. If that process was operating, the other side might be involved secondarily on account of spread of infection to the other ureter. The third process was that of neuro-muscular dysfunction. The innervation of the ureter was carried in the outer coat in a similar manner to that of an artery; it was supplied from the lower end and from the upper end. The anatomy of sympathectomy had not yet been satisfactorily determined. Dr. Price went on to say that the innervation at the lower end was from the presacral plexus and the *nervi erigentes*. The effect of nerve stimulation on the ureter was not known precisely; it could function even if denervated; there might be an intrinsic mechanism. He remarked that the diverticulum might be causing obstruction mechanically by involvement of the nervous mechanism; by that theory the retention of urine might be explained also. He felt persuaded that the mechanism was neuro-muscular, and if the diverticulum was removed there was a fair chance of curing the condition. He added that in 5% of cases of megacolon enlarged ureters were found. Silicon particles introduced into the subperitoneal tissues were alleged to have produced irritation and subsequent dilatation.

DR. HAROLD MOORE also expressed doubt as to whether, in face of the reflux, it was reasonable to postulate that the dilatation of the ureter was due to obstruction. He thought that the diverticula were of congenital origin, but that the size of a diverticulum would be increased by obstruction. He also thought that the retention of urine was not due to a diverticulum, but that both were due to a common factor. He expressed the opinion that Dr. Brown should make sure that there was no actual obstruction to the urethra; if he was sure of that, he should remove the diverticulum later and transplant the ureter. Dr. Moore quoted a case in which, after removal of the diverticulum, a condition of megaloureter had developed within six months.

DR. KEITH HALLAM said that the extreme vulnerability of a ureter must be taken into consideration. A ureter was apt to become greatly dilated, because it was a flexible, unsupported tube. Persistent colic and a state of reflux with infection seemed to him to be sufficient to cause the dilatation of the ureter.

Dr. Brown, in reply, agreed with Dr. Moore that the question of possible urethral obstruction was of extreme importance; he said that he would make a urethroscopic examination and pass sounds down from above when he had opened the bladder. He remarked that Hyman had noted in all three of his cases that the ureter was involved and had to be transplanted. In the case under discussion Dr. Brown was satisfied that the infection was minimal as a result of treatment by washing out of the bladder, catheterization and administration of sulphanilamides.

DR. H. DOUGLAS STEPHENS suggested that the patients shown by Dr. Price and Dr. Forster should be the subject of a group discussion.

DR. HAROLD MOORE referred to the variety of theories of hydronephrosis. He said that pain was usually an evidence of distension, though it could be caused by irregular action. Dr. Price had not only performed sympathectomy, but had divided a vessel to the upper pole; that division of the vessel might have had much to do with the abolition of pain; the kidney was freed, and as it was no longer tied down the pain was relieved. With special reference to treatment, Dr. Moore said that there was no measure recognized as uniformly satisfactory. He recalled that on one occasion Dr. Upjohn had performed a plastic operation on the upper end of the kidney in a somewhat similar case; but if he remembered correctly, the procedure was not a success. Dr. Bridge, of Sydney, had devised an operation in which the muscle was divided down to the mucous membrane, as in the Rammstedt operation of pyloroplasty; but Dr. Moore understood that that operation also was not satisfactory.

With reference to Dr. Price's case of congenital stricture, Dr. Moore said that the fact that the fistula had closed was indicative of relief of obstruction. Instead of trying to perform a plastic operation, he suggested that Dr. Price should attempt to transplant the ureter into the bowel or into the bladder elsewhere, provided that the site of the obstruction was not too high.

With reference to Dr. Forster's case of "double ureter", Dr. Moore pointed out that the condition rendered the kidney more prone than usual to pathological changes, and though the damage was often localized to one ureter, it was seldom if ever practicable to perform hemi-nephrectomy, which was the operation indicated on theoretical grounds.

Dr. Brown said that some seven or eight years earlier Dr. C. H. Osborn had successfully carried out hemi-nephrectomy for "double ureter" without great difficulty.

Dr. Price, in reply, referred to the treatment of double hydronephrosis by presacral neurectomy, which he had reported at a meeting of the society in 1937. The patient's condition had not been permanently improved.

Dr. Forster commented on the helplessness of a surgeon who encountered double hydronephrosis in young children. He believed that plastic operations were being performed with greater satisfaction recently than earlier, but he confessed that he had not yet attempted to perform a plastic operation on a renal pelvis.

DR. H. DOUGLAS STEPHENS, from the chair, observed that the occurrence of pyelitis in male children should be regarded as a reason for investigation of the condition of the urinary tract. Diverticula were very rarely found in childhood, though he understood that they were much more commonly found in adults; if they were of congenital origin, more frequent investigation would lead to earlier discovery.

## Obituary.

### ARTHUR EDWARD MILLS.

WE are indebted to Dr. C. G. McDonald for the following appreciation and account of the career of the late Dr. Arthur Edward Mills.

Arthur Edward Mills, the youngest son of Thomas Edward and Mary Mills, was born at Mudgee, New South Wales, on February 13, 1865. His father was a mining agent at a time when the gold fever raged in the districts of Mudgee and Gulgong, and one of his duties was the allotment of miners' rights to sanguine prospectors. Arthur attended the newly built school in his native town, to which after a few years came a young teacher named Robert J. Hinder, well known in later years as the headmaster of the Sydney Boys' High School. Hinder wrought a strong influence on the boy—an influence more enduring because he lived with the Mills family—and, recognizing his scholastic ability, he urged him to embrace teaching as a profession. The lad became a pupil teacher. But he was not happy in this calling. Only fourteen years old, he suffered many trials of patience and many embarrassments in his efforts to discipline boys of sixteen years or more. He resigned after a few years; but in later life he recognized the value of this teaching experience, which not only fostered his love for learning, but laid the foundation of his future career as a teacher of medicine. In the evenings he studied hard and taught himself Greek, an achievement of which he was wont to speak with scarcely concealed pride. The studious habits of this boy of fourteen were not always favourably judged. His brother Walter, a surveyor, invited him during a Christmas vacation to act as a chainman. The appointment, unhappy in its conception, was soon terminated, for the reason that Walter could seldom find his brother, who, intolerant of the tedium of holding the chain, would drop it and repair to a shady tree to study. Arthur had ambitions and he was already preparing for the entrance examination to the university. Robert Hinder, who had meanwhile married Arthur's only sister, Sarah, had been transferred to Sydney, and he invited his brother-in-law to spend a school vacation in Sydney. Here Arthur Mills met Harry V. C. Hinder, Robert's brother. They became fast friends, and it was the expression of Harry Hinder's intention to enter medicine that determined his friend's decision to do likewise. Arthur Mills sat for and passed the matriculation examination, and with Harry Hinder entered the University of Sydney as a student of arts and of medicine in 1885. At the end of that year he had fulfilled the first-year requirements of both faculties and thereupon became a second-year medical student. In those days honours were awarded in each subject of the medical curriculum, instead of the distinctions and credits which are given now, and "honours on graduation" were based, as now, on the total of the marks obtained over the whole course. During his five years at the university Mills achieved honours in classics, mathematics, chemistry and experimental physics, botany, anatomy, physiology, pathology, medicine, surgery and midwifery. He was awarded second-class honours on graduation in 1889. The graduates of that year were seven in number: Arthur Henry, J. W. Hester, H. V. C. Hinder, P. J. Kelly, Aeneas McDonnell, A. E. Mills and R. B. Trindal. They were the second fruit of the Sydney Medical School, which in the previous year had produced its first crop of six graduates.

The Royal Prince Alfred Hospital had been opened for the reception of patients in 1882. In 1889 Mills, along with Arthur Henry, J. W. Hester and his friend Hinder, became a resident medical officer. John F. McAllister, a graduate of Melbourne University, was medical superintendent. The honorary physicians at that time were Alfred Shewen, Murray Oram and James Cox; the assistant physicians were R. Scot Skirving and David Collingwood. The honorary surgical staff included G. T. Hankins, George E. Twynam, Samuel Knaggs, Alexander (now Sir Alexander) MacCormick, Charles P. B. Clubbe and William Chisholm. From these the young graduate received much help and encouragement, especially from Sir Alexander MacCormick, with whom he had formed a close friendship while a student. He remained in residence for a part of 1890, along with the graduates of that year. Of these, Dr. Cecil Purser and Dr. John Morton are still alive and remained his lifelong friends. At the end of his residency at the hospital Mills was invited by Dr. J. T. Wilson, who had been demonstrator in anatomy since 1887 but had just been appointed to the Challis chair in that subject, to become demonstrator for a period of twelve months. He was the first Sydney graduate to hold this appointment. The influence of this experience at the university, apart from the knowledge he acquired in anatomy, was enormous and took a twofold form. On the one hand his natural love of scholarship developed into a deep affection for academic life, and on the other he became a zealous apostle of the scientific aspect of medicine. This development he owed to the inspiration of three great medical scientists, all of them working as young men at the university, all of them fired with a love of science and of truth, and all of them happily still alive. The first was Professor Wilson, who was later called to Cambridge as professor of anatomy, and who is now living in retirement there; the second was Dr. C. J. (now Sir Charles) Martin, who was till recently the director of the Lister Institute in London, but in the early nineties was demonstrator in physiology at Sydney in succession to Almroth Wright; while the third was Dr. (now Professor) James P. Hill, who became demonstrator in biology at Sydney University in 1892 and later occupied the chair of embryology at University College, London, till his retirement a few years ago. These three exercised a profound influence on their new colleague, and it is not too much to say that he, with his quick and original mind, influenced them. After their departure one by one from Australia intercourse was still maintained between them and him by frequent correspondence and rarely by his visits to England or theirs to Australia. Under happier conditions Mills would have elected to remain at the university and to have pursued a career of research in physiological and experimental science. But the tug of his inclinations had to be resisted. He had no money, he was engaged to be married, and no remunerative academic post was vacant. He decided to marry and to begin general medical practice at Picton, his friend Dr. John Morton attempting a similar venture at Camden

about the same time. But Picton was no plum for the picking. Another practitioner was well established in the town, and the inhabitants showed no eagerness to consult this young and inexperienced doctor who had come amongst them. Mills saw for the first time the spectre of poverty when, his small savings consumed, he literally lacked the wherewithal to live. Then an epidemic rained from heaven and work abounded. The grim battle was over, and those who had called him to their bedsides consulted him again and sent other patients to him. Ambitious for wider fields, he sold his practice at Picton in 1894 and moved to The Boulevarde, Strathfield, where he worked hard for fourteen years. It was this experience that ripened his knowledge of medicine and of mankind; of medicine, because he was never content to let his scientific knowledge stagnate, but by omnivorous reading and persistent observation and inquiry probed as far as he could the mysteries of clinical medicine; of mankind, because his visits to his patients' homes led him, like so many others, to realize that knowledge of human nature was a most important equipment of any physician. The vast number of patients and friends whom he met in his Strathfield experience clung to him when he commenced consulting practice, and to the very last day of his life it was these in the main who still sought his sympathy and skill. In 1910 he and Dr. Cecil Purser, who was practising in The Boulevard, Lewisham, moved to Macquarie Street, where both became consulting physicians in the same building and on the same day.

Meanwhile, his transfer to Strathfield in 1894 allowed him to renew his associations with the university. He was offered by Professor Wilson, and he accepted, the position of examiner in anatomy. For many years he continued to perform this function, and many are the stories of the stern tests to which he put many a quaking student. Professor Wilson was a relentless inquisitor and his co-examiner was no less redoubtable. He demanded accuracy and speed of answer, and no tactical shuffling by a student succeeded in avoiding a full exposure of his ignorance. The two examiners soon discovered with uncanny accuracy whether a student knew his work or not. Mills had at last to resign this position owing to the enormous growth of his practice and to another circumstance which was destined to determine the main work of his life; for in 1898 he had been appointed an honorary assistant physician at the Royal Prince Alfred Hospital, and with characteristic energy and zeal worked and taught in the out-patient department.

The dawning of the twentieth century revealed three outstanding figures on the junior medical staff of the hospital. These were, in order of seniority, George E. Rennie, Arthur E. Mills and Sinclair Gillies. Perhaps never before and never since could the hospital boast of so strong a team. Each member differed in his method and in his views, but each was a striking personality, whether for scholarship or vigour of thought or both. These three laboured in the out-patient department from 2 p.m. to 6 p.m. or later, and by their enthusiasm and teaching capacity set a standard which few of their successors could achieve. Mills was a teacher to his finger-tips, and students crowded round this tall figure who swept others forward on the tide of his enthusiasm and whose tirelessness in instruction was only matched by the unwearying interest of those whom he inspired.

The position of lecturer in the principles and practice of medicine fell vacant in 1910 on the resignation of Dr. W. Camac Wilkinson, who had decided in 1909 to move his household gods from Sydney to London. Mills was a strong candidate for the post and received the appointment. And now occurred a minor crisis in his career. Students who had been accustomed to lecturers serving their wares on a silver salver resented the treatment to which they were now subjected. They expected a systematic exposition of the ætiology, symptomatology, diagnosis and treatment of all the important diseases. Instead, they heard with growing impatience lectures on the physiology of pain, the fundamental importance of symptoms, the applied anatomy and physiology of the nervous system, the new knowledge of nutrition, the general principles of treatment, in fact anything extraneous and foreign and nothing which would help them to answer a straightout question on a common disease. It was little consolation that this lecturer spoke with warmth in his voice and a flash in his eye; that at one moment he moved them to mirth and at another almost to tears; that he had a message and a mission. They listened, and then the more rebellious among them went to the Dean of the Faculty, T. P. Anderson Stuart, and demanded either the lecturer's reform or his removal. That wise builder of the Sydney University Medical School referred them back to the offending lecturer, who listened gravely, promised them he would indeed teach them the science and art of medicine, and forthwith proceeded to lecture as before. Within a short time these youthful rebels became his enthusiastic disciples. They hung on every word that fell from his lips, and soon realized that medicine as taught by Mills was the most fascinating subject in the curriculum. The new lecturer was the high-priest of the new medicine which was being built on physiological conceptions applied to disease. The old empiricism was yielding to the new rationalism. The question "Why?" rang from the lecturer's lips not once but a thousand times, and successive classes of students caught up the cry till every clinical teacher was forced to give reasons for his statements or run for cover. In those days textbooks dealing with the physiological basis of medicine were unknown; they are almost legion today. Few teachers in the world had turned aside from the old tradition, but one of these few was Mills. When Sherrington delivered his Silliman lectures on "The Integrative Action of the Nervous System" in 1906, when James Mackenzie published "Diseases of the Heart" in 1908 and his "Interpretation of Symptoms" in 1910, and when the elder Haldane wrote his "Respiration" in 1920, Mills recognized at once the brilliance of these works and expounded the principles they embodied in intelligible language at the bedside or in the class-room, or criticized their conclusions out of his own knowledge and experience. At the same time he was expounding many of the views on wide and varied subjects born of his own fertile mind, some of them proved erroneous by time, but others (and they the greater) now part of the accepted teaching all over the world.

The advent of war in 1914 interrupted the even flow of university life. Courses were shortened and "war examinations" held. Mills had seen signs of the coming storm when he had visited Germany with Professor E. R. Holme in 1906. He had lodgings then in a house in Berlin which was next door to a military academy. He related in after years how he had one day watched cadets of tender age playing happily in the street when suddenly one of them shrieked *"Offizier!"* A sudden silence fell on the little band; they quickly formed up in military line, bodies stiff and hands at the salute, although the lieutenant was half a mile away, and thus they remained till the officer, disdainful of them all, passed and was long lost to view. This little incident burnt into his memory and gave him a passionate hatred of militarism. The year 1915 found him a member of the Australian Imperial Force on a transport bound for England. But his military career was short-lived. He found himself idling his time away in London, with no consecutive tasks to do. Others might have borne this disappointment with patience; but military discipline had no terrors for Mills. He sought out the most senior officer whom he could find, and had a stormy interview. This was followed by another and yet another. Then, just as he was preparing to join Sir Almroth Wright's hospital in France, whither he had applied to be sent, a request came for his return to the University of Sydney, and in the middle of 1916 a disappointed soldier was on his way home.

On his arrival in Sydney, Mills flung himself with redoubled energy into teaching and hospital work. Even on Saturdays and Sundays he visited the Royal Prince Alfred Hospital and spent hours taking tracings with Mackenzie's ink-writing polygraph or working with microscope and test-tube on biological tissues and fluids. It was his belief in those days that a good physician should be his own pathologist and, as far as practicable, biochemist. When, the war over, medicine took a revolu-

tionary turn and biophysics and biochemistry began to dominate clinical science, Mills was already a master of these subjects. The topics of dyspnœa, cyanosis, œdema, reactions of blood and tissue fluids and the other countless problems of clinical medicine found in him a vigorous and able exponent. The large army of students in the post-war years crowded his lecture hall, followed him through the wards and asked him for more and more instruction, which he willingly gave. In 1920 he was appointed professor of the principles and practice of medicine, and held the post till his retirement in 1930. The new chair, with its larger emoluments of office, enabled him to devote the greater part of his time to university work. This indeed soon became a necessity, for in the same year Professor Wilson was translated to Cambridge and Mills succeeded him as dean of the Faculty of Medicine. Like his predecessor, he was a strong dean, just and sympathetic in his dealings with the staff, but intolerant of inefficiency and never hesitant to expose it. This new post gave him a seat on the university senate, in which he soon became a powerful and influential figure. As is well known, appointments to the honorary staffs of certain teaching hospitals are made by a conjoint board of the senate and the directors of the hospital concerned, on the recommendation of a committee of certain members of the two bodies. Early in his deanship Mills presented to the conjoint board a recommendation from the selection committee that a certain medical man be appointed, whereupon a member of the senate moved an amendment that another candidate receive the position. This led to protests by members of the committee that it was useless for the committee to meet unless its recommendations were accepted. The late Judge Backhouse, a senator, but not a member of the committee, then intervened, saying vehemently that he for one refused to function as a "rubber stamp". The new dean saved the day by tactfully comparing the claims of all the candidates and enumerating the reasons for the committee's choice. The judge at once gave his support to the recommendation and thereafter had implicit faith in Mills's judgement. Mills followed this procedure in every future recommendation which came before the senate. The members of that body soon learned to trust his counsels and ultimately he became a virtual dictator of the faculty. He wielded his power wisely and justly, unmoved by personal influence. It was characteristic of the man that if he disapproved of the action or word even of a friend he would never hesitate to say so. This sometimes alienated the affection but never the respect of his colleagues.

Despite the claims of the deanship on his activities and time, Mills never relaxed the duties of his professorship or his work at the Royal Prince Alfred Hospital, of which he was now senior physician. All his teaching was leavened by humanity and salted with his inimitable wit. Two excellent pen pictures of him about this time appeared in the *Senior Year Book* of 1924 and its successor of 1925. This is the first, quoted in part:

> With all our preconceived notions pleasantly falsified, we settled down to enjoy "Arty", secure in the conviction that a year of valuable instruction varied by much amusement was in store for us, and, as brilliant lecture succeeded brilliant lecture, we felt that we would not be disappointed. Where else in this or in any other University could one find principles, solidly buttressed by scientific facts, presented in a manner so diverting that the most inattentive must grasp and remember them. Here is another example of his unorthodox ways, for Professor Mills believes that it is the duty of the lecturer to be interesting, and not the duty of the audience to be interested. The measure of his success is the number of people who turn up at the unholy hour of half-past eight in the morning, and, by the experience of those who turn up on the stroke of time to his optional lectures at R.P.A.H., and who have difficulty in finding a seat (those who arrive late have to sit on the floor). "Arty's" way of keeping order is as original as his teaching method. The "gentlemen in the back row" are not asked to leave the room, but the turbulent spirits are put to shame by having aspersions cast on the power of their higher nervous centres. The success of this plan makes one imagine what a success "Arty" would be as a political speaker. Surely the most experienced and irreconcilable heckler would be reduced to stupefied silence on hearing himself described as a "poor thalamic individual entirely devoid of cortical control".
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> His method is as refreshingly novel as his manner. No dull and uninteresting differential diagnosis for him; his appeal is to the reason, not to the memory. Descartes was fond of saying "*Cogito, ergo sum*", and on this he built up his system of philosophy; "Arty" merely asks the simple question "Why?" and on that he builds up his wonderful system of clinical teaching. "Why" forms the burden of every lecture, and the defenceless ladies in the front row are harassed with inquiries as to the causes of phenomena that they had regarded as too commonplace to need explanation. Sometimes the guns are turned on an unfortunate male in the second row, who is adjured in such terms as "Pain, pain, pain, what is the cause of his pain, Mr. H——?" Those victims who are fortunate enough to supply an explanation are received into lifelong friendship, while those who do not are reproached with being "weak in the faith". That little word "why" has probably been the basis of many nightmares; if Dante had lived in our time we might have had another Circle in the Inferno, where the shades of wicked persons who advocated the use of lettuce and spinach, or who taught that little "bubbas" should be fed by the clock, would be compelled for ever to explain their reasons to implacable and unconvinced inquisitors.
>
> If the Dean is inspiring in the lecture hall, what shall be said of his instruction at the bedside? His visits are surely red letter days in the calendar of a ward. The sight of his little company with the blackboard and easel, like a baggage train bringing up the rear is sufficiently striking, in the patient's opinion at least, for they all strain to see and hear as much as possible. When all the chairs in the ward have been commandeered, and everyone is seated comfortably round a bed, the performance begins. "Arty", strong in his panoply of physiological knowledge, darts questions like swordthrusts here and there—none may escape; it is quite useless to hide behind a more burly companion; the question will find you out and you must stand forth and give some sort of reason or confess complete ignorance. Each symptom is examined thoroughly and the causes underlying it are discovered; thus, by gradually tracking them all to the fountain head, a common cause is unearthed, and the diagnosis made. Here, reason reigns supreme; no statement, even though it be backed by the sacred authority of Osler, will be accepted, unless the "why and wherefore" are fully explained, and scorn awaits him who cannot give his reasons for the "faith that is in him".

And this is the second:

> One day, when the gods were in a merry mood, in intervals of divine laughter, they made Arthur E. Mills. On another day, when their brows were heavy with serious thought, they made him Professor and Lecturer in Clinical Medicine. On another day still, when they were very, very wise, they made him Dean of the Faculty of Medicine at the University of Sydney. These three sources of his triple destiny have never ceased to flow and intermingle with his life.
>
> When the eyes twinkle and the face twists, when the legs start dancing and the arms start flying in all strange places and ways, when the staccato infectious laugh breaks from the thin wreathed lips, when the microscopic hairs wriggle and twist upon the macroscopically bald head, you can be sure the gods are merry and the heavens laugh, and Arthur E. Mills, with a stick of chalk behind one ear, a duster in one hand and his body balanced upon one leg, is happy. Now, if ever, is the time to revel and riot in thy

youth. Now, if ever, is the bacchanal. But such is not always, O brothers!

There comes a day when the thin lips set firm with a grimness almost saturnine, a day when the once dancing eyes take a steely glint, a day when the thin hands grasp with prehensile clutch the most baffling bottle in the pathology department and a stern judicial voice asks questions, striking echoes from your very soul. On these days the brows of the gods are lowering, the lightning flashes and the thunder hangs about Olympus. On these days learn to speak thy part, thy whole part and nothing but thy part. This do . . . or perish.

We have tried to indicate some of the strange lights, glinting in ever baffling fashion from a personality that has as many facets as it has angles of incidence and angles of refraction. For Arthur E. Mills was born as a riddle, lived as an enigma and will probably die something of a cross-word puzzle.

His lectures were on the whole light fare—light but very wholesome. "Moderation, gentlemen, moderation in all things. What did St. Paul say?" But if we did not imbibe anything approaching an access of knowledge, we certainly digested and digested thoroughly the nutritious morsels we did consume. That after all was the main thing.

It would be idle to try to set down in cold print the many joyous adventures and happy jousts that we shared under the tuition of Professor Mills. Each student carries beneath his frontal bosses a copious store of Millsian anecdotes and Millsian wiles.

We learnt all his pithy phrases by heart. It would be hard to find a student who could not deliver a Harveian Oration upon a plastic tone, anoxæmia or referred pain. There will be none of us who throughout a long and we hope useful life will not bristle and turn baleful at the mention of the word "back-pressure". There will be none of us who will not smack his chops and look learned at the mention of the word "vertigo". There will be none who will not brighten and grow eager at the mention of the word "Mills".

On Sunday mornings he took groups of students to the Infants' Home at Ashfield, where he demonstrated the method of infant feeding which he had himself devised. From its establishment and for thirty-five years he was the senior medical officer of this institution. In the first decade of this period the death rate of children in Australia from gastro-enteritis was appalling. Mills achieved remarkable success by his methods. The mortality, not only from gastro-enteritis but from other infections, fell steeply under the system which he imposed until ultimately the death of any baby at the home became a rarity. He always believed in the liberal feeding of children, maintained that more babies were underfed than overfed, and with copious aphorisms and pungent wit poured scorn on those who grimly watched the clock and withheld nourishment from a screaming child because there were "a few minutes to go". To thousands of laymen he was known as "the children's specialist", and when Mr. Lionel Lindsay made a celebrated pen-drawing of him in humorous vein, it was as Saint Luke, the physician, in cassock and girdle, with a circle of chubby children romping round him. Successive generations of students, struck by the success of his methods, imitated them in their practices and in their own homes, and thus extended in ever-widening circles the influence of the principles which he had laid down.

In 1930, at the age of sixty-five, he retired from the chair of medicine. He was at the height of his intellectual powers, but he went willingly. No man could maintain such intensity and volume of work indefinitely. He was already chief medical officer of the Mutual Life and Citizens' Assurance Company Limited, a position which had been offered to him by the late Sir John Garvan, and he decided to divide his time between this activity and consulting practice. But his association with the university was not terminated. In 1929 he had been elected a Fellow of the Senate by convocation, and he was reelected in 1934. He did not seek reelection in 1939. In February, 1937, he was appointed deputy chancellor. When at the end of 1939 he doffed the robes of this office, his friends at the university and his former students commissioned Mr. William Rowell, the Melbourne artist, to paint his portrait in oils for presentation to the University. Happily, this portrait was just completed in time. In the early afternoon of Wednesday, April 10, 1940, he died suddenly in the city from coronary occlusion at the age of seventy-five years.

Thus passed one of the great figures of Australian medicine. Outstanding among his qualities were his originality of thought, his moral courage and his kindliness of heart. His originality led him to anticipate developments in medicine which at the time seemed fantastic. His courage brought him bitter enemies and loyal friends. At no time did he seek popularity, and often the hornets of opposition droned round his ears. He was a born champion of lost causes and was never so happy as when he went down fighting for a principle. But more often than not he won through by sheer faith in the cause that moved him. Such tenacity could not go on for ever. In the last few years of his life he mellowed and the kindness of heart and gentleness of spirit which no combative qualities could ever hide from his friends became patent to all. The fire of battle died down in his eyes. But the light of his mind was undimmed. To the end he was a student, cognizant of every real advance in medicine and receptive of any new idea which could withstand criticism. He had an amazing capacity for reading. At the height of his career, when monographs and text-books and innumerable journals crowded his bookshelves, he read them all and still found time to browse in the broad domain of general literature. There was hardly any work of value in history, biography, travel or fiction which he had not read. A copy of the New Testament lay on the table beside his bed, and from it he read a little each night. It was this love of the written record of the actions and thoughts of men which enlarged his humanity and gave him his breadth of view.

He was twice married. His first wife was Ida Cecilia Archibald, who predeceased him by many years. He had four children, three of whom survive—Mrs. J. M. Campbell, of Dural, Mr. John Mills, of "Bonny Rigg", Quirindi, and Mr. Robert Mills, of "Arroo", Charleville, Queensland. The fourth, a daughter, was killed when she was thrown from a polo pony at Singleton in 1913. In 1932 he married Miss Helen Garvan, of Edgecliff, the sister of his friend Sir John Garvan. To her the University of Sydney owes the tasteful redecoration and furnishing of its senate room.

Mills's published papers include the following:

"Notes on a Case of Cerebral Tumour", *The Australasian Medical Gazette*, May 20, 1899.

"Notes on a Case of Pulsating Exophthalmos", *The Australasian Medical Gazette*, July 20, 1899.

"Appendicitis from the Physician's Point of View", *The Australasian Medical Gazette*, June 20, 1901.

"A Case of Hydatid of the Brain—Operation and Recovery" (with Alexander MacCormick), *The Australasian Medical Gazette*, November 21, 1904.

"The General Principles of Therapeutic Inoculation, with Special Reference to Tuberculin", *The Australasian Medical Gazette*, July 20, 1908.

"Infant Feeding at the Ashfield Home for Infants", *The Australian Medical Journal*, April 13, 1912.

"Some Nerve Injuries Seen on Active Service", THE MEDICAL JOURNAL OF AUSTRALIA, January 27, 1917.

"The Symptomatology of Disorders of the Stomach from the Physiological Aspect", THE MEDICAL JOURNAL OF AUSTRALIA, October 5, 1918.

"Spastic Paraplegia of Spinal Origin", THE MEDICAL JOURNAL OF AUSTRALIA, August 8, 1919.

"Multiple Peripheral Neuritis due to Toxæmia of Pregnancy", THE MEDICAL JOURNAL OF AUSTRALIA, October 18, 1919.

"A Lesion of the Optic Thalamus", THE MEDICAL JOURNAL OF AUSTRALIA, November 8, 1919.

"Bronchitis due to Empyema of the Maxillary Antrum", THE MEDICAL JOURNAL OF AUSTRALIA, May 22, 1920.
"Papilloedema", THE MEDICAL JOURNAL OF AUSTRALIA, February 26, 1921.
"The Importance of the Acid Content of the Gastric Juices in the Ætiology, Symptomatology and Treatment of Gastric and Duodenal Ulcers", THE MEDICAL JOURNAL OF AUSTRALIA, March 25, 1922.
"Vertigo", *Australasian Medical Congress, Transactions of the First Session, Melbourne*, 1923.
"Glycosuria", THE MEDICAL JOURNAL OF AUSTRALIA, May 19, 1923.
"The Treatment of Diabetes", THE MEDICAL JOURNAL OF AUSTRALIA, August 4, 1923.
"Some Effects of Disturbance of the Physiology of Movements of the Gastro-Intestinal Tube", THE MEDICAL JOURNAL OF AUSTRALIA, February 7, 1925.
"Vascular Disturbances as an Explanation of Nervous Symptoms", THE MEDICAL JOURNAL OF AUSTRALIA, February 11, 1928.
"Medicine—A Retrospect", *Year Book*, Royal Prince Alfred Hospital Medical Officers' Association, 1932.

Dr. S. A. Smith writes:

The writer of a biographical sketch of Arthur E. Mills has rich material to hand, because his life, although apparently cast in pleasant places, was that of a man with the vision of a pioneer, a forerunner and the strivings, misunderstandings, loyalties and even antipathies which are engendered by a man of strong and vivid personality who tilts against authority and orthodoxy. Mills was above all a teacher, but never a doctrinaire. His appointment first as lecturer and later as professor of medicine in the University of Sydney found him ready for the most important work of his life. He had been influenced profoundly by J. T. Wilson and C. J. Martin, and had long pondered on the project of teaching medicine on a basis of fundamental principles. He embraced with almost missionary ardour the opportunity for urging on his students and his associates the necessity for returning to the ground work of physiology and biochemistry and their pathological application. This was indeed heterodoxy in that day. The physiologist had been relegated by the curricula of the time to his laboratory cell, far removed from the problems of actual disease in the living human being. Tradition or the accepted beliefs of our forefathers in clinical medicine had attained an authority equal to the precedents of the lawyer.

What a shock were those lectures to his first group of students! I well remember Mills's despair when after toiling night and day to give his lectures form and proper substance, he found that his students did not understand, in spite of the vividness of his exposition and the wealth of clinical illustration. These lectures were simple enough in all conscience. They were directly and immediately related to the problems of disease in man, woman or child (very frequently the latter) who came for treatment. They were humanistic and sought to bring the knowledge of the medical sciences to the help of the patient. They were not given over to the abstractions which characterize the cold minds of limited or lesser men who do not see the human being beyond the test-tube.

Undaunted, Mills set about recasting his lectures. The writer was honoured by being the dog on which some of these were tried, and can bear witness to the seriousness which possessed Mills in this task. The students of those days divided themselves into two groups, those who scorned his lectures because they did not open up the easy path to passing examinations, and those who were inspired by his philosophical approach and found themselves led into that healthy iconoclasm which is necessary to all medical progress. But ultimately all were influenced, some in spite of themselves, and his point of view has now become orthodox. In a ship travelling to Europe he had a small operation performed. It was followed by a pulmonary infarct, the symptoms of which he noted with great accuracy and detachment. He made a good recovery, and after reaching England, while the guest of a great physiologist, an authority on respiration, he took pride in pointing out to the great man the cause of the severe dyspnœa which marked the onset of the attack. That which is a commonplace to us today was a matter for prolonged and spirited argument at that time.

As a teacher, university senator and as a man Mills was a great fighter for what he believed was right. No man was more ardent in his search for truth and none more outspoken in proclaiming it when he imagined he had found it. Nobody who came in contact with him was ever in doubt as to where he stood. Candour and bluntness were striking characteristics, never so strikingly shown as when he was confronted with the pompous, the insincere, the self-satisfied and the omniscient.

Combined with this was a high degree of loyalty to his friends, a genuine and enquiring interest in art and literature and human affairs. And with it all an extraordinary sprightliness of manner, which he carried right through to his later years.

Dr. Kevin Byrne writes:

Royal Prince Alfred Hospital students doing medicine in 1914-1915 were very fortunate in having as teaching physicians the late Dr. Rennie, Dr. Mills, Dr. Gillies, also Dr. (now Sir) Charles Blackburn and Dr. Fairfax. There have been more learned physicians than Mills, but few who could better teach a student beginning medicine the mysteries of clinical approach. He stressed the importance of inspection as an aid to diagnosis. "There are more mistakes through not looking than through not knowing" was his frequent statement. His bedside lectures were popular with students, conducted as they were in an atmosphere of informality, humour and intense "medical clue-finding".

His sometimes apparently flippant manner had an underlying seriousness and enthusiasm. Mills had a ready wit, as the following conversation will show. The scene was a *viva voce* anatomy examination (Mills was an anatomist in his early days).

Mills (holding up a kidney): "Which side?"

Student: "Inside."

Mills (pointing to door): "Outside!"

The chastened student was later sent for by Mills, who, with a kindly twinkle, resumed the examination.

Recently Mills was the guest of some who at dinner celebrated our twenty-fifth year of graduation. "Artie" had altered little in appearance, manner or wit. Ten days later he passed on.

Dr. W. A. Bye writes:

During the years following the last war Professor A. E. Mills lectured to large groups of students in the final year of medicine. Numbers of these men had recently returned from the war and they did not find it easy to continue their academic studies. Minor manifestations of turbulence of spirit were not infrequent during various stages of the course. Mills, however, controlled and swayed his audience at will. He preferred to teach principles rather than systematic medicine. The student was instructed to write the word "why" on the mirror of his dressing table and to attempt to interpret symptoms and their mechanism from his knowledge of anatomy and physiology. The value of such teaching is more apparent to some of us now than it was years ago. Lectures of this type could not have been easy to prepare or deliver. They were, however, presented in such a way that interest and enthusiasm were stimulated and captured, and there can be few who heard them who will not always remember something of them.

Frequently there was the spice of some illustrative story, such as that of the small boy who, accustomed to sleep with his father, awoke one night and without warning or apology vomited upon his father (at this stage the professor illustrated how a small boy would vomit upon his father). Soon after the boy developed scarlet fever. He vomited because he had an acute infection. The lecturer knew the story was true because he was the father. Thus we were taught that vomiting occurred in acute infections.

Many of us will remember a tall figure so capable at times of creating awe in our minds, yet suddenly casting aside professional tradition and dignity like an impish small boy to pace the floor with some grotesque or simulated gait, or demonstrate an athetotic movement. Then again, some luckless "laddie boy" might suddenly be called upon, blushing and surprised, to draw upon the board a diagram of a section through the mid-brain or the pons.

Thus with continued interest and diversion he taught his principles. Later, when he gave optional clinical lectures in the "A2" lecture theatre at the Royal Prince Alfred Hospital, extra chairs were always put out in front of the usual seats. Students came from other hospitals and many sat upon the steps or on the floor.

Some of those who were privileged in later years to know him well realized that these were the happiest days of his professional career, and long after he had ceased active teaching he liked nothing better than to recall these days and to see and hear of his old students. It followed naturally that scores of these students later availed themselves of his knowledge and his skill. He inspired, encouraged and befriended many young men, and it disturbed him to know that he could not keep in touch with many of them after he relinquished his hospital appointment. Quite a small band of his students and residents have gradually obtained staff appointments as years have passed, and some of us learned to know him well.

To not a few of us whose acquaintance with him began in student days and ultimately ended in deep friendship and esteem, it was a privilege to have small glimpses into the happiness of his home and to realize that he was still deeply interested in our problems and still willing to help us.

The teacher and friend has now passed on. Many of his ideas and much of his teaching still live and will be handed on by his students and his friends. We shall still ask questions, although we have learned that often there is no answer. And to those of his students who now teach and follow on, there remains the memory of his example, which it is our duty to strive to follow.

# Naval, Military and Air Force.

## APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 99, of June 6, 1940.

### AUSTRALIAN MILITARY FORCES.

SOUTHERN COMMAND.

**Third Military District.**

*Australian Army Medical Corps.*

Lieutenant-Colonel I. Blaubaum is appointed from the Reserve of Officers (A.A.M.C.), 1st January, 1940.

**Fourth Military District.**

*Australian Army Medical Corps.*

Honorary Captains L. J. T. Pellew, R. Motteram and P. C. R. Goode are appointed from the Reserve of Officers (A.A.M.C.) and to be Captains (provisionally), 9th May, 1940.

WESTERN COMMAND.

**Fifth Military District.**

*Australian Army Medical Corps Reserve.*

*To be Honorary Captains*—Ian Conrad Heinz and Kevin Keely, 13th May, 1940, and Geoffrey Ashburton Thompson, 16th May, 1940.

### ROYAL AUSTRALIAN AIR FORCE.

**Permanent Air Force.**

*Medical Branch.*

Wing Commander E. A. Daley, M.B., B.S., D.T.M., is granted the temporary rank of Group Captain with pay of that rank with effect from 1st June, 1940.—(Ex. Min. No. 28—Approved 5th June, 1940.)

**Citizen Air Force.**

*Medical Branch.*

Squadron Leader B. B. Davis, M.B., B.S., is transferred from the Reserve to the Active List, with effect from 1st April, 1940.

The probationary appointment of Flight Lieutenant G. C. Bury is terminated, with effect from 12th May, 1940.

**Reserve.**

*Medical Branch.*

John Parkes Findlay, M.B., Ch.M., is granted a commission on probation with the rank of Flight Lieutenant, with effect from 1st June, 1940.

Florence Charles Burke-Gaffney is granted a commission on probation with the rank of Flight Lieutenant and the honorary rank of Squadron Leader, with effect from 1st June, 1940.—(Ex. Min. No. 29—Approved 5th June, 1940.)

# Correspondence.

## TREATMENT OF SYPHILIS BY HEAT.

SIR: When last in Honolulu this method of treatment was being carried out successfully in cases of neurosyphilis. It is obvious that if late syphilis can be treated successfully in this way, it is likely that primary syphilis may yield to treatment.

In Hawaii the patient was enclosed in a box provided with fans. The blood pressure was cautiously watched, and if collapse was threatened the treatment was discontinued. My recollection is that high temperatures up to 106° F. were employed.

Dr. Prior is to be congratulated on the adoption of a simpler technique and to have found that temperatures of 103·5° are useful for the most part and that temperatures of 106° and 107° need not be lengthy. The treatment is combined with the use of bismuth and arsenic. The extensive trial of this method will be looked forward to with great interest. So far the results are encouraging.

Yours, etc.,

JAMES W. BARRETT.

103-105, Collins Street,
Melbourne, C.1,
June 3, 1940.

## NOTICE.

THE Section of Neurology and Psychiatry of the New South Wales Branch of the British Medical Association is holding a symposium on the cerebellum and its diseases. The first meeting was held on June 20, 1940. The second will be held on July 22, 1940, when Dr. A. K. McIntyre will speak on the physiology of the cerebellum and Dr. O. Latham on its pathology. At the third meeting to be held on September 19, 1940, Dr. S. M. Morson will discuss the diagnosis of cerebellar disease, Dr. Douglas Miller will speak of the surgery of extracerebellar tumours and Dr. Gilbert Phillips on the surgery of intracerebellar tumours. All the meetings will be held at the Robert H. Todd Assembly Hall, British Medical Association House, 135, Macquarie Street, Sydney, and will commence at 8.15 o'clock p.m.

## Nominations and Elections.

THE undermentioned have applied for election as members of the South Australian Branch of the British Medical Association:

Ferguson, William Frederick, M.B., B.S., 1940 (Univ. Melbourne), "Mareeba" Babies' Hospital, Adelaide.
Woods, Charles William Griffin, M.B., B.S., 1939 (Univ. Adelaide), Kilkenny.

The undermentioned has been elected a member of the South Australian Branch of the British Medical Association:

Smith, Keith Viner, M.B., B.S., 1939 (Univ. Adelaide), Royal Adelaide Hospital, Adelaide.

The undermentioned have been elected members of the New South Wales Branch of the British Medical Association:

Buckley, Joseph Gregory, M.B., B.S., 1936 (Univ. Sydney), 112 Willison Road, Carlton.
Cumming, Gordon David, M.B., B.S., 1936 (Univ. Sydney), 42 Victoria Parade, Manly.
Johnson, Adrian Mackey, M.B., B.S., 1939 (Univ. Sydney), 2/5 Field Regiment, A.I.F.
Schloeffel, Brian Ramsden, M.B., B.S., 1940 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
Tandy, Dorothy Rosemary, M.B., B.S., 1939 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

The undermentioned has been reelected a member of the New South Wales Branch of the British Medical Association:

Alcorn, Robert Mandeville, Lic. Lic. Midwif., 1914, R.C.P., Ireland, Lic. Lic. Midwif., 1914, R.C.S., Ireland, Box 76, Peak Hill.

## Diary for the Month.

JUNE 25.—New South Wales Branch, B.M.A.: Medical Politics Committee.
JUNE 26.—South Australian Branch, B.M.A.: Annual meeting.
JUNE 26.—Victorian Branch, B.M.A.: Council.
JUNE 27.—New South Wales Branch, B.M.A.: Branch.
JUNE 28.—Queensland Branch, B.M.A.: Council.
JUNE 28.—Tasmanian Branch, B.M.A.: Council.
JULY 2.—New South Wales Branch, B.M.A.: Council (Quarterly).
JULY 3.—Western Australian Branch, B.M.A.: Council.
JULY 3.—Victorian Branch, B.M.A.: Branch.
JULY 4.—South Australian Branch, B.M.A.: Council.
JULY 5.—Queensland Branch, B.M.A.: Branch.
JULY 9.—Tasmanian Branch, B.M.A.: Branch.

## Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser", pages xiii-xv.

ANTI-TUBERCULOSIS ASSOCIATION OF NEW SOUTH WALES: Honorary Physician.
AUSTRALASIAN PETROLEUM CO. LTD.: Medical Officer.
CHILDREN'S HOSPITAL (INC.), PERTH, WESTERN AUSTRALIA: Junior Resident Medical Officers.
DEPARTMENT OF PUBLIC HEALTH, VICTORIA: Resident Medical Officers.
ROCKHAMPTON HOSPITALS BOARD, ROCKHAMPTON, QUEENSLAND: Assistant Medical Superintendent.
SYDNEY HOSPITAL, SYDNEY, NEW SOUTH WALES: Honorary Officer.
THE ROYAL NORTH SHORE HOSPITAL OF SYDNEY, NEW SOUTH WALES: Junior Resident Medical Officer.
THE TOOWOOMBA HOSPITALS BOARD, TOOWOOMBA, QUEENSLAND: Resident Medical Officer.

## Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment referred to in the following table without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1

| BRANCHES. | APPOINTMENTS. |
|---|---|
| NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney. | Australian Natives' Association.<br>Ashfield and District United Friendly Societies' Dispensary.<br>Balmain United Friendly Societies' Dispensary.<br>Leichhardt and Petersham United Friendly Societies' Dispensary.<br>Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney.<br>North Sydney Friendly Societies' Dispensary Limited.<br>People's Prudential Assurance Company Limited.<br>Phœnix Mutual Provident Society. |
| VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne. | Associated Medical Services Limited.<br>All Institutes or Medical Dispensaries.<br>Australian Prudential Association, Proprietary, Limited.<br>Federated Mutual Medical Benefit Society.<br>Mutual National Provident Club.<br>National Provident Association.<br>Hospital or other appointments outside Victoria. |
| QUEENSLAND: Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17. | Brisbane Associate Friendly Societies' Medical Institute.<br>Proserpine District Hospital.<br>Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing. |
| SOUTH AUSTRALIAN: Secretary, 178, North Terrace, Adelaide. | All Lodge appointments in South Australia.<br>All Contract Practice Appointments in South Australia. |
| WESTERN AUSTRALIAN: Honorary Secretary, 205, Saint George's Terrace, Perth. | Wiluna Hospital.<br>All Contract Practice Appointments in Western Australia. |

## Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

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## ROCKHAMPTON HOSPITALS BOARD.

APPLICATIONS are invited for the position of ASSISTANT MEDICAL SUPERINTENDENT to the Rockhampton Hospital at a salary of £500 per annum plus board and quarters at the Hospital. Single man required and experience in public hospitals essential. State age, qualifications, experience and forward a copy of references. Applications close June, 1940.

WM. THOMSON,
Secretary.

## RESIDENT MEDICAL OFFICER (MALE), GRESSWELL SANATORIUM, MONT PARK.

Department of Public Health, Victoria.

(Temporary Appointment.)

APPLICATIONS, addressed to the Secretary to the Public Service Commissioner (Victoria), Public Offices, Treasury Place, Melbourne, C.2, and accompanied by evidence of experience and qualifications, including copies of three recent testimonials, and a statement of date and place of birth, are invited up to Saturday, the 6th July, 1940, for the abovementioned position.

*Duties.*—To assist the Medical Superintendent in the work of the Sanatorium.

*Qualifications.*—To be a registered medical practitioner, with at least one year's post-graduate hospital experience.

*Salary.*—£400 a year, with board and lodging.

## SYDNEY HOSPITAL.

APPLICATIONS, addressed to the President and endorsed "Honorary Medical Staff", will be received up to 12th July, 1940, for appointment to the above-mentioned hospital as

(1) Temporary Honorary Relieving Assistant Gynæcological Surgeon (2 vacancies) for a period of approximately twelve months.

(2) Honorary Clinical Assistant to the Department of Orthopædics and Special Therapeutics (1 vacancy) for a period of approximately five months.

Apply to the Medical Superintendent for further particulars and application forms.

Canvassing of members of the Board, either directly or indirectly, will disqualify applicants.

A. F. BURRETT,
Secretary.

## THE ROYAL NORTH SHORE HOSPITAL OF SYDNEY.

JUNIOR RESIDENT MEDICAL OFFICER.

APPLICATIONS will be received up to noon on 26 June, 1940, for the position of JUNIOR RESIDENT MEDICAL OFFICER at the above Hospital. Applicants should state age and forward copies of two testimonials. Salary at the rate of £100 per annum with quarters, board and laundry, plus bonus of £25 on completion of twelve months' satisfactory service.

By order,
J. H. WARD,
St. Leonards. Secretary.

## TOOWOOMBA HOSPITALS BOARD.

APPLICATIONS are invited for a RESIDENT MEDICAL OFFICER, salary £400 per annum, with board and quarters for a single man. Daily average 150 including maternity section.

Applicants, please state age and experience, state when can commence duty, and forward copies of testimonials.

Applications to be lodged with the undersigned on or before Monday, July 1, 1940.

D. McINNES,
Secretary.

WANTED.—A Portable X-Ray—Bucky and Ultra Violet Lamp. Give full details. Dr. Davis, Rutherglen, Victoria.

YOUNG LADY, 19, stenographer, 16 months' nursing experience, seeks position typist receptionist. 'Phone FJ 1478.

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